

SUPER SIX MOTORSPORTS

PowerPak Installation Instructions

Now that you have your new heads, ported intakes, and cam, you're ready to get it installed and running. Perhaps you've decided to do it yourself rather than hiring it out. If you intend to do this yourself, first make sure you have a few extra hands lined up to help. It's a big job, but its not really difficult. Plan on 24 or more hours to get it done, working methodically the entire time.

Some preliminaries first.

Here's what you'll need:

Head gaskets, Fel-Pro 9642PT-1, order (2). This is actually the 3.8L SuperCoupe head gasket, perforated steel core with graphite facings and preflattened steel ring in the fire ring.

Intake gasket set, Fel-Pro MS94045, includes (2) lower-to-head gaskets, (2) cork end seals, the upper-to-lower gasket, a small tube of black sealant.

Thermostat and thermostat gasket

Timing cover gasket set, includes water pump, housing, timing cover, oil pump, front main seal

Head bolts, Fel-Pro ES72156, order (2) sets

Header gaskets, Ford, order 2

Assembly lube, ARP 100-9903, or equivalent

Thread sealer, ARP 100-9904, or equivalent

Black sealant, Permatex UltraBlack hi-temp gasket maker

Anti-seize, VersaChem type 13 or equivalent, Red Locktite

Standard and metric sockets and deep wells including 3/8" and 1/2 drive, universals

Standard and metric open/box ends

Common head screwdrivers of various sizes

Torx bit set

Snap-lok set

Rubber handled hammer or rubber mallet

Pry bar

Duct tape

Magnetic retriever

Pliers, water pump pliers, needle nose pliers

Dampener puller/installer

Cheater bars of various sizes

Penetrating oil

Torque wrench

5 quarts of 10W30 oil

Oil filter

2 gallons antifreeze/coolant

Spark plugs

Power steering fluid

A healthy supply of rags

Funnel, buckets, empty milk jugs, etc

PlastiKote hi-temp engine enamel if you're doing any painting

If your engine has high miles, you'd be advised to purchase a new timing chain, hydraulic roller lifters, and pushrods.

Now, these instructions are not a step-by-step, its just too much work to attempt to cover in that much detail, you must pickup a Haynes or Ford service manual for that purpose. Before the first wrench is turned you must read the manual and be thoroughly prepared.



OK, you've been through the manual and its time to start. Looking at your engine now, you have a better perspective of the work involved. So lets get started.

First, disconnect the battery before doing anything else. Have some zip-lok bags or boxes ready to label and segregate the various nuts, bolts, studs, etc. This is important because you can not remember where they all go. Make some sketches to identify the location of the various bolts as your remove them. This will dramatically improve your reassembly. Also note that penetrating oil is your friend, squirt all the bolts that you'll be removing with this stuff giving it a few minutes to penetrate.

Drain the coolant at the coolant petcock. Disconnect the cooling fan and remove it. Loosen the water pump pulley bolts but do not remove them. Loosen the crank pulley bolts. Now, you can loosen and remove the big dampener bolt. A couple of pointers here. On rotating objects such as the pulleys, use two sockets, opposed 180 degrees apart to simultaneously hold the pulley and loosen the bolts. On the dampener you'll need to wedge something between the dampener and block or between the dampener and floor as leverage to prevent its rotation during removal. We also left the belt on the engine to aid in loosening the water pump and crank pulley bolts, but now you can use your ratchet to pull up the tensioner and remove the belt. Now, remove the water pump pulley and use your dampener puller to remove the dampener.



Now, disconnect the MAF, air temp sensor, and remove the entire inlet system from the filter to the throttle body. Cover the throttle body opening or stuff it with rags. Now, climb into the open space in front of the engine. Disconnect alternator and remove it. Remove the power steering pump while still installed in the big bracket. You do not have to remove the pulley, but you'll need a universal to get one or two of the bolts off. Lift the assembly up, disconnect the two hydraulic lines and be prepared with a catch bucket. You are marking and identifying where the bolts go, right? Go to the other side and disconnect the coil pak and remove it all the way to the wires at the plugs. Make sure that the plug wires are numbered or some way identified. Disconnect the air conditioner compressor. Remove it from the bracket and hang it from something. Alternatively, you can have it evacuated and totally remove it to make more room to work. Did you know that we have an air conditioning eliminator kit that bolts right on to the 3.8? While your at it, it eliminates the weight of the A/C compressor and hoses and frees up some horsepower too! If you elect to totally remove the air conditioning system, have it evacuated then use your snap-lok tools to disconnect the lines. Remove the air conditioning bracket. You can now disconnect the cam position sensor, crank trigger, and oil pressure sender but do not remove them. Starting to look a little better now. And your confidence is up right?



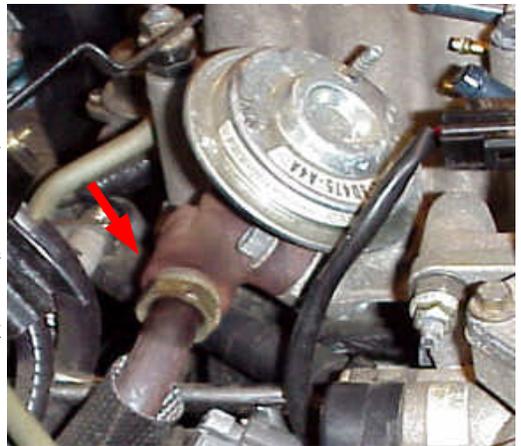
Speaking of snap-loks, they are the connectors used to hold together pressurized lines like fuel, A/C refrigerant

etc. It takes special tools to disconnect the connectors. Look at the picture, it shows how to use the tool. Slide it into the connector as shown, push the tool into the connector to release the internal spring and pull on the hose. If the proper tool is used it will pull apart.



Lets work on the top now. We have to get the upper intake off. Its held on by 6 bolts and the big EGR nut. Soak that EGR nut with penetrating oil. Use a healthy adjustable to break it loose and back it out. Now, loosen the bolts and prepare to remove the upper intake, but first, take a good look at all the vacuum routing and make detailed drawings and notes as to where they all go. You'll be sorry later on if you don't. OK, disconnect these vacuum and EGR lines, and disconnect the throttle position sensor, idle air control, throttle and cruise control cables, and EGR, and carefully lift the upper off. You'll notice that the PCV line is attached to the bottom of the lower. Just pull the PCV valve out of the valve cover and take it and the tube out with the upper. Immediately stuff rags down into the ports in the lower or duct tape them closed.

Now, lets remove the headers, squirt the bolts/studs and get busy, don't forget the collector nuts, upper HEGO's and the lower EGR nut. Just loosen the lower EGR tube nut and let the EGR tube and the smog stuff come out with the header. Note the location of bolts vs studs with respect to installation of the oil dipstick tube on the driver's side and the coolant bypass tube on the passenger's side. Before proceeding, take a good look at the relationship between the wiring harness, the coolant bypass tubes, fuel rail etc. Again, this is a place where good notes and detailed sketches will save much time later. For the most part the connectors are different, but the injector connectors are not, label them if you need to. OK, now lets get those coolant bypass tubes off. Note: No Smoking. Now, use your snap-loks and disconnect the fuel lines. Some fuel will spill, so get some rags and mop it up. We'll leave the injectors connected to the fuel rails, so just remove the fuel rail bolts, wiggle the injector connectors loose, and pull up on the rails. Keep the injectors out of any dirt. Now, disconnect the coolant temperature and air charge sensors and lay the fuel line up onto the cowl apron.



Another word of caution, you must keep the engine covered to prevent any foreign objects such as tools, nuts, etc from falling down into the engine, otherwise, it gets ugly real fast.

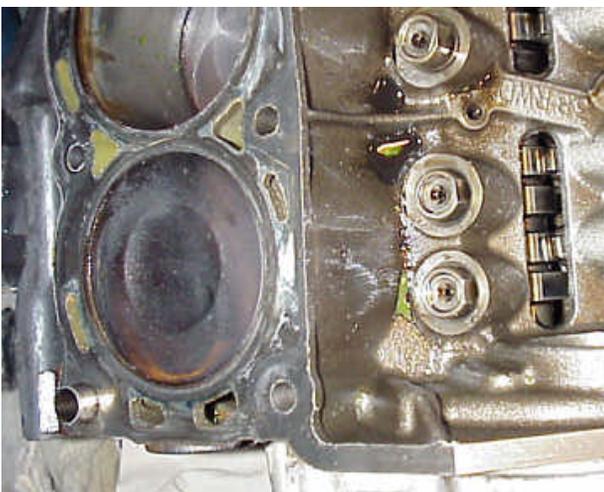
Next, remove the valve covers and note the location of bolts vs studs. Now, remove the upper intake manifold, its just a bunch of small bolts and studs, note where they go. Gently lift or pry the lower intake manifold off. Use rags to cover the open valley. Now, lets remove the valve covers and rocker arms. Label the position of each rocker arm so they go back exactly where they came. Remove the pushrods and also label them by cylinder and valve. Now the heads, but first plug up or tape the exhaust pipes closed. 8 bolts per head. They are mondo tight. Use a 1/2 inch breaker bar with a cheater and a hard quick push to break them loose. Remove all 8 and lift the head up. Expect a deluge of coolant that will run down the outside of the block. Some will run into the bores and the fastener holes. Get that out of there and oil the bores with WD-40.



Now, onto the timing cover. Before we remove the timing cover, we must get the cam position sensor out, but it must be removed properly, if not, you'll need the Ford cam position sensor alignment tool. To remove the sensor, use that crank bolt to turn the engine in the clockwise direction until the #1 cylinder is top dead center on the compression stroke. What is top dead center? TDC is the point of maximum compression, that is when the piston is at the very top of the stroke on the compression stroke. How do you know where that is? Watch the piston and the lifters. When the piston on the #1 cylinder is at the very top, you know if it's the compression stroke because both lifters will be resting on the base circle of the cam lobes, i.e., all the way down in their lifter bores. With #1 at TDC, unbolt the cam position sensor hold down. Make a mark on the sensor where its attached to the block, and make a matching mark on the block using a permanent marker. Slide the sensor straight out. Do not turn it, make another set of alignment marks on it and the drive shaft, and tape it down with duct tape so it can't rotate. Make sure you do this right and you won't have any timing problems during reassembly. You can remove the water and oil pumps if you intend to replace them. If you plan to reuse them, they can stay attached to the timing cover to simplify the job. Look at the bolts, its easy to tell which attach the timing cover to the block and which attach the water pump and oil pump to the timing cover. OK, lets remove the bolts which attach the timing cover.



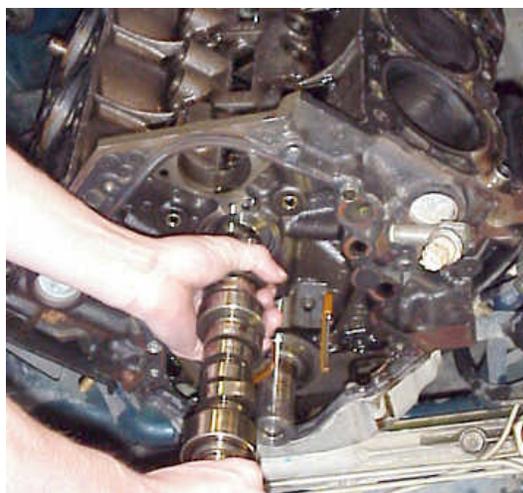
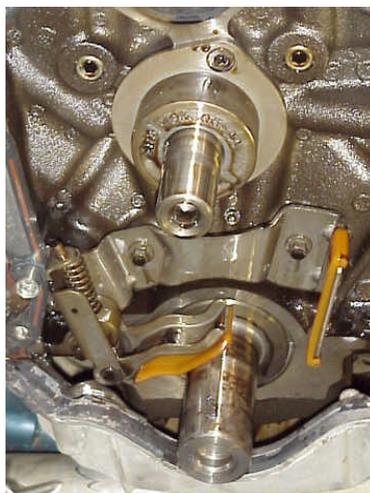
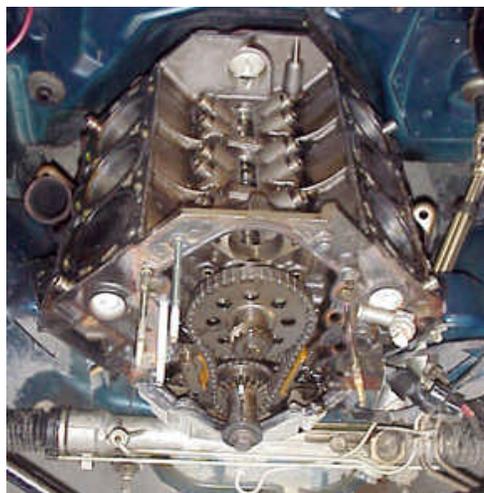
Contrary to popular opinion, there is no hidden bolt that requires removal of the oil pan, but there is a small socket cap screw down under the oil pump that must come out. Now that is done, but here's where it gets, well lets say, trying. Trying because you must try to get it (the timing cover) off without breaking it. It has a couple pry tabs at the top, so get a screwdriver behind there and gently pry loose. Don't worry, it seems fruitless but keep at it, but do not pry on any of the gasket surfaces or they can be damaged. When you give up prying, take your hammer's rubber handle or rubber mallet and start tapping on it. Keep at it till it comes loose, it just takes some time. Carefully remove it and set aside. You'll also want to remove the studs from the block because you can get a better seal at the oil pan when its reinstalled if the studs are removed. To remove the studs, just use two jam nuts and back them out. Again, make drawings as to where they go. Now, lets look at the timing marks on the crank and cam sprockets. These two marks should be pointing directly at each other, if not, you were not at TDC. Don't worry, your cam position sensor marks are still valid, just make sure that during reassembly that you maintain this same pointer relationship when the cam position sensor is reinstalled, get it, its just a matter of maintaining the relationship between the cam position sensor's position and the location of #1 piston when the sensor was removed. All you have to do is go back to those positions during reassembly.



Install the dampener bolt back into the crank. Now that the timing cover is off, lets see how this thing works. Turn the crank clockwise as if you are tightening the dampener bolt. You can look into the valley and watch the cam rotate. At the same time, look at the lifters as they rise in fall. You should see the cam lobe come around, then the base circle, it will be important later on to be able to recognize the base circle position as the lobes pass by. Bring everything back to #1 TDC with the timing marks perfectly aligned (pointing directly at each other).

OK, now lets get the cam out. Remove the lifter hold-downs and the lifters, make sure to identify the lifters so that the lifters, pushrods, and rocker arms all go back in the same place. To remove the cam, we have to re-

move the timing chain, and to do that remove the cam gear bolt, the gear, and the big spacer. Now, slide both the crank pulley and cam gear slowly forward, they come right off. You don't have to remove the timing chain tensioner. Look at the manual, it gives a very helpful hint regarding cocking the tensioner spring. Or, you can just cock the spring manually during reassembly, unless its kind of bound up, then you'll have to remove it to cock it. With the timing chain off, remove the cam retainer, it uses a Torx bit. We can remove the cam now. Pull it straight out, gently, being careful not to nick the bearing races. It will come straight out. The radiator is far enough away to allow you to lift the cam straight up and out.



Now its time for one of the most demanding jobs, the preparation of the gasket surfaces. Before anything goes back together, we have to get the gasket surfaces perfectly clean. To do this use a scraper for the tough stuff, but be very careful not the nick or gouge the gasket surfaces or you might have a leak there. Once the tough stuff is off, use a surface conditioning disc on a drill motor to get a nice non-directional finish on the gasket surfaces. Do not grind away on the surfaces, just use the conditioning disc to clean it up good. You can also decarbon the piston crowns with the surface conditioning disc at this time. Now, wipe the gasket surfaces with acetone as the final preparation step.

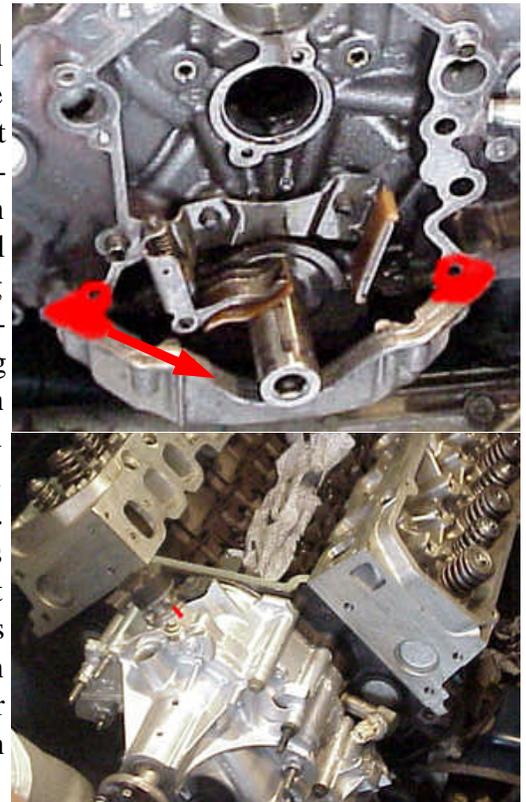


Before we start reassembly we need to transfer some stuff from the old parts to your new stuff. It's a few things on the upper intake, like the throttle body, EGR vacuum valve, PCV line with PCV valve attached. Some stuff on the lower like the coolant bypass fittings and the sensors.

We're ready to reinstall the cam. Lube the cam lobes and bearing journals with assembly lube and gently slide it straight in, slowly. Lock it in place with its retainer. Yes, we're putting it back in the exactly the opposite order that it came apart. Reassemble the spacer, timing chain set, and gears. Its all keyed, so it goes back together only one way. Remember that the key on the crank shaft identifies how it goes back together, so just rotate the cam to get the key aligned with the keyway. You'll notice that the timing pointers should line up just they way they were when you removed them if the #1 piston has not been moved, if it has been moved, line them back up like they were. We want to reinstall the timing cover and get the cam position sensor installed to make sure they timing is still accurate. Before we do that, we have to cock the chain tensioner, remember, or else the chain won't slide all the way home. A word about that. The service manual tells you to work the spring up and pin it into place, then to pry up on the bottom of the slider with a large screw driver, nah, it never works. The other way is to remove it and put it in a vise. Work the spring up and pin it in place through the hole. Now, wiggle the slider up with a screw driver. When you get it up, strap the tensioner slipper down with a zip tie, now its cocked and locked in place. Reinstall it, slide the timing set on, then cut the zip tie. Now the chain is properly tensioned again, pull the zip tie out. You had to remove the crank bolt to slide the timing gear on, so put it back now.



Now, lets pre pare to put the timing chain cover, water pump, and oil pump back on. Double check gasket surface cleanliness and remove any rags you had stuffed into the open part of the oil pan. First, lets get a nice bead of the black, hi-temp silicone sealant at the corner intersection of the oil pan and block. Run the sealant up the block around an inch and around the lower fastener hole on each side. Run the bead all the way across the oil pan lip as well. Coat both sides of the timing cover gasket with sealant and set it in place. Now, we can set the timing cover in place. With the studs removed, you can get a better seating of the timing cover down onto the front oil pan lip than you can with the studs in place. With the timing cover in place, lube the stud and bolt threads with assembly lube and run them up, then tighten them down. Don't forget the little cap screw down there under the oil pump. Now, take your cam position sensor, unwrap the tape, make sure its own marks are aligned and that it has not been rotated, and insert it back into its bore while carefully aligning the cam postion sensor marks with the one you put on the timing cover. Once inserted, lock it down with the hold down. If you use this opportunity to do some painting or polishing of the timing cover, make sure you maintain the cam position sensor mark.

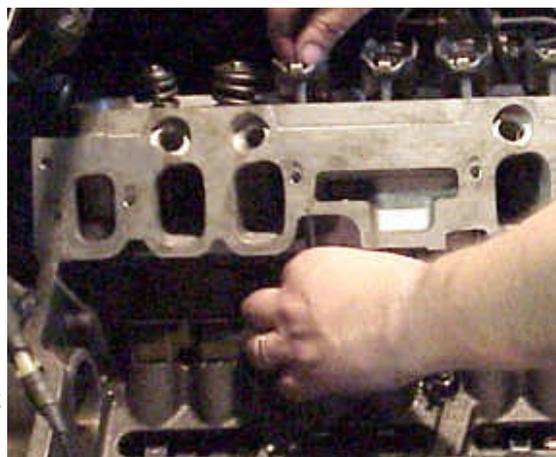


Lets put the new heads on. Did you compare the ported heads to the old, greasy stockers? Cool huh? You're installing the better SuperCoupe gaskets. You must install them with the "FRONT" side facing the front, don't worry if it looks upside down, it doesn't matter as long as the "FRONT" is toward the front. This is important, get it right, and double check it. Double check cleanliness on the block gasket surfaces too. Set the head gaskets in place onto the dowels in the block. If they are not there, they will be stuck in the bottom of the heads you just took off, pull them out and put them back into the block. Do not use any sealant or anything else on the head gaskets, just place them and sit the new heads gently down in place. Now its fun time, torquing the heads. Lube the bolt threads and head washers with the assembly lubricant recommended by the

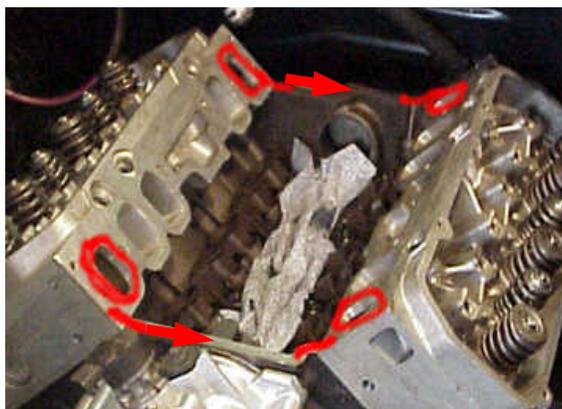
fastener manufacturer. This is done in steps, you must follow the procedure called out in the manual. Take your time and do it correctly. These torque-to-yield bolts require an additional turn after the final torque is reached. You'll need a cheater bar to do it. Once the heads are torqued and the rocker arms set and adjusted, it goes back together pretty quickly.

Now, its time to set-up the valve train. You can set the lifters back in the bores and secure them with the retainers. If you washed the lifters, oil them before reinstalling. Apply a dab of assembly lube on the pushrod tips and place the pushrods back into their respective holes and make sure they go into the retainer and rest in the center of the lifter. You did put the lifters in with the rollers riding on the cam, right? Now, get the rockers arms, fulcrums and bolt ready to go back into their same respective positions. Before you bolt any of them down you need to look at something. The rocker arms and the fulcrums have some angled grooves in them, make sure when you reinstall them that the grooves match up in the same direction. If you observe severe wear on the mating surfaces, you'll need to replace them. Also inspect the valve tip as well. Apply a dab of assembly lube to the valve tip of the rocker arm and the pushrod seat before they are assembled. Starting with cylinder #1 at TDC, apply assembly lube to the fulcrum bolt and just start it after the assembly is set into the pedestal.

Now, lets get the rockers adjusted. Before we go on, lets say that adjusting the rockers perfectly is something that you may not get right the first time. That's OK, you can always remove the valve covers and torque them again. Moving on, rotate the pushrod as you hand tighten the fulcrum. It will be loose, don't expect it to tighten up. Once its hand tight, you'll use your torque wrench to finish tightening it the rest of the way. You'll need to see 22-29 lbs-ft of torque as you rotate the fastener an additional 1/4 to 1 full turn. The rocker may still be slightly loose even after its tightened in this manner. If you must go more than 1 full turn and the torque has not developed, longer pushrods will be required. Comp Cams part number 7939-16 are 7.150 " long and should do the trick, but measure any lash before hand before ordering. You can install and adjust both the intake and exhaust valve rocker arms of the #1 cylinder. Once that is done, you'll rotate the crankshaft to the next cylinder in firing order sequence, i.e., #4. You must watch the cam lobes go by as they rotate so that both the intake and exhaust lifters of the #4 cylinder are positioned only on the base circle of the cam. You must adjust the rockers only when the cylinder is at TDC on the compression stroke, i.e., when both lifters are riding on the base circle of the cam. Once #4 is torqued, on to next cylinder in firing order sequence, 1-4-2-5-3-6, etc until each is complete.



Congratulations, the hard part is done. Lets get the lower intake back on. Before you get ready to instal it, you must transfer some stuff from the original over to the new one, things like the throttle body, EGR valve, coolant temperature sensors and sending unit, etc. Make sure you use thread sealant or teflon tape where the coolant temperature stuff is installed to prevent coolant leaks. Before we go any farther, make sure the gasket surfaces are perfectly clean and wipe the gasket surfaces with acetone. Match up the gaskets to the ports to verify the fit, some trimming of the gaskets may be required. Now make a healthy blob of sealant at the corners of the front and rear China walls that laps up onto the heads. Make a narrow bead of sealant around the coolant transfer holes in

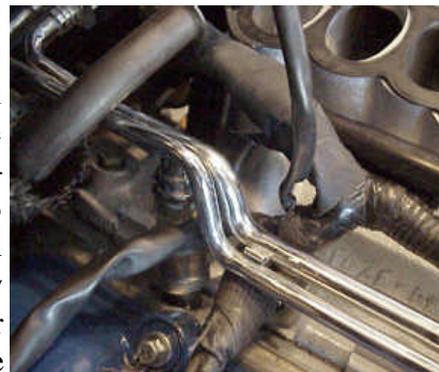


the heads. Immediately lightly coat both sides of the lower intake-to-head gaskets with the same black hi-temp gasket sealer. Set the gaskets in place and align the ports for the best match. Make yet another fine bead of sealant on the gasket around the coolant transfer holes. Finally make a healthy bead of sealant all the way across the front and rear China walls starting up on the intake gasket and finishing up on the opposite intake gasket. This is important. By sandwiching the intake gaskets at the China wall corners in sealant, there is little chance of leaks occurring there. This is not the time to take a break, you want the sealants curing as one continuous mass. Note that we have not used the crummy cork China wall gaskets that came with the Fel-Pro kit. Set the lower intake straight down, look into the ports to verify that it is aligned properly, if not, then shift it slightly. Lets get it bolted down with the fasteners using the proper thread lubricant, torque, and sequence. Remember to get the bolts and studs in the right positions. Stuff clean rags into the ports to protect them from loose objects. You don't want to disassemble all that again.

Move on to the valve covers. Inspect the seals before you bolt them on. Make sure the bolts and studs go back into the proper places. If you want them painted, now is the perfect time.

Now to the headers. Get the gaskets in place and tighten the fasteners after they've been treated with anti-seize. If the HEGO's were removed coat their threads with anti-seize and reinstall them prior to installing the headers. You may find it helpful to start the header collector to flange bolts at the same time just make sure its all aligned prior to tightening the header bolts down. Make sure you get the bolts and studs in the right place because some of the studs are used to fasten the coolant bypass on the passenger side and the oil dipstick on the driver's side. While we're here, lets get the oil level dipstick back in place with a little shot of sealant, then bolt it to the stud on the drivers side header.

We're rolling now. Its time to get busy with the wiring harness, fuel rails, coolant bypass, t-stat, t-stat housing, etc. If it seems that all of this stuff is woven together, its because it is. Lets start with the fuel rails and get them bolted back down. Now lets run the wiring harness back across the top the engine. You'll notice that the connectors only go one way, and, with the exception of the fuel injectors, are different for each connection. You need to wind the passenger side under the fuel rail. The injector connectors are laid out logically so don't worry if you didn't label them. Just look at where they come out from the big bundle and hook them up in that order. Pay particular attention to how you route the connections to the throttle body, the throttle body wiring must come out under the fuel rail behind the rear-most fuel rail hold down on the passenger side. With all wiring and vacuum routing, make sure your routing eliminates rubbing and chafing and direct contact with sharp edges, headers, EGR lines, etc.



Its time to get the upper on. Like the lower, you have some things like the throttle body, EGR valve, PCV valve, etc to transfer. Once that's transferred, the upper goes on with 6 bolts, don't forget the throttle cable and cruise control cables, and make sure you hook the throttle return spring up. Reattach the EGR and all vacuum connections.

Now, instal the front accessory brackets and accessories and make the electrical connections. Move on to the crank pulley, then the water pump pulley, now wrap the serpentine belt. Use red loctite on the crank pulley bolts. Reinstall the radiator fan and coolant overflow bottle.

Go around to the passenger side and reconnect the fuel lines and the A/C lines, if you disconnected them, they just push in and lock in place.

Now, drain the oil, remove and replace the filter, and refill with 5 quarts of oil. Refill the radiator and coolant system with a 50-50 coolant/antifreeze water mixture. You need to remove the coolant fill vent that is located in the lower intake as you add coolant, and reinstall it with thread sealant and tighten it before you start the car. Refill the power steering.

Now, look everything over one last time. Check coolant and oil levels, then hook the battery up and get behind the wheel. First, just bump the engine over a couple times. If all sounds well, its time to fire that thing up. Its important to listen carefully to the engine for tapping, knocking, or any other unusual noises. If all went well, it should start right up and run pretty quietly. If you hear a metallic tapping noise, its probably the rocker arms. Listen and feel the valve covers to determine which side it may be coming from. You'll need to pull the valve covers and tighten the rocker arms some more or install the longer pushrods. Now, with the cam, your car should pretty quickly develop a lopey idle. Don't worry if it idles up a little high at first. In a few minutes it should start to idle down to around 700-800 rpm. You'll want to drive it kinda easily for a while until everything is properly run-in again. Pay particular attention to oil pressure and coolant temperature gages. Any unusual gage activity indicates that some additional attention is required.

You may also notice some white smoke coming from the tailpipes. Its not really smoke, its actually coolant vapor that's coming from any spilled coolant that leaked into the exhaust pipes. If that's what it is, it will stop after a few minutes.

Lets talk about what you need to do next. You might get a MIL or check engine light after a driving cycle or two. If so, check them with a scanner, we like the B&B Electronic's AutoTap the best. Sometimes, an emissions system or vacuum connection is wrong or the computer has sensed a now lean mixture. This means more fuel is needed to go along with the new airflow capacity. That's why we offer Stages 2 and 3. Now, get out there and pick-up those fuel system mods and the chip to attain maximum performance.

