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How to build a "reliable" lsvtec/b20vtec

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I put this guide together because I'm tired of seeing the SAME threads over and over of simple questions that can be answered in one simple post like this one. This thread is designed to be an end-all, tell-all type thread. Please keep in mind though, that this is still just a general guide. Lsvtec/b20vtec engines are not honda manufactured engines. With that said, there are hundreds of combinations you can build.

Also, please be aware that this guide is assembled on an intermediate level, and in my opinion anyone reading this guide can perform all of the steps outlined. I left out things like how to hone cylinders, install bearings, pistons, rings, valve seals, etc. Because honestly, I don't want people attempting it based on my techniques, screwing up their motor because they are idiots and then ruining my credibility.

Let's begin. Now, in my opinion, there are a few NECESSARY things to do/parts to buy when building a "reliable" lsvtec/b20vtec:

- LS ARP rod bolts
- GSR ARP head studs
- New OEM LS (90-01) B18a/b head gasket
- New OEM/ACL LS bearings
- Shotpeen LS rods
- New hastings/OEM LS piston rings
- New OEM valve seals

Hone cylinders

New GSR/ITR 22T water pump (P72)

New GSR/ITR timing belt (P72)

New GSR/ITR/96+ Bseries oil pump (P72)

Magnetic oil drain plug (important for break in)

New NGK V-power BKR6E spark plugs (stock pistons) OR NGK V-power BKR7E spark plugs for 10.8:1+ compression.

Do the above, and your motor will reward you with reliability.

Other things to consider:

A 2.5 inch header, cat, exhaust piping, and muffler.

Hondadata/Passwordjdm intake manifold gasket

Adjustable cam gears (even for stock cams, because Isvtec timing will ALWAYS be slightly off)

Adjustable Fuel Pressure regulator

Want to make 200 whp with your Isvtec?

P30(SIR2 B16)/PCT(CTR) pistons or forged 11.5:1+ pistons

Higher lift/longer duration cams (read below for cams)

Stiffer valve springs (read below for valve springs)

Tuning

Want to make more than 200WHP?

Better intake manifold (ITR, AEBS, Skunk2, JG, Ported ITR)

Port/Polish head

Better header (RMF narrow, SMSP 4-2-1 style, Rage/Hytech style, etc.)

310cc injectors (at a minimum)

Then go and tune the shit out of it!

Now, let's get started.

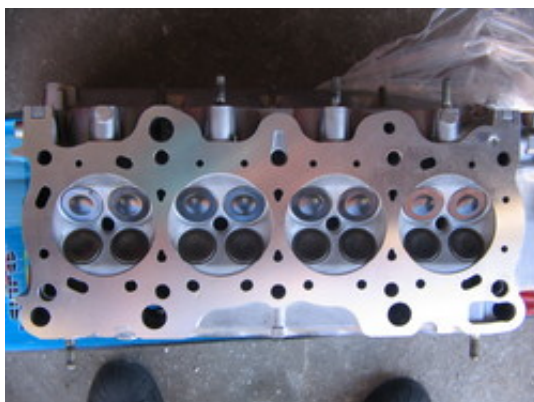
First, we can't get started without the Assembly lube, RTV, and 30W ND oil (to break in the rings.), and coolant. It will be good to have handy a 10, 12, 14, 17, and 19mm box wrenches as well as shallow and deep sockets in the same sizes. It would also be good if you could have those same sockets in both 3/8 drive and 1/2 drive (but it is not necessary). Pick up a 3/8 drive, and 1/2 drive 6 inch extension, as well as the equivalent sized socket wrenches. You will also need a ft/lbs torque wrench as well as a inch pounds torque wrench. Pick up a deep 5/8, 16mm or spark plug socket. Forgive me if i'm forgetting any tools, but these are the main ones. The only additional tools required for working on any other part of the car including installing the engine are 8mm's, 32mm's (axle nuts), and a couple flat heads and screwdrivers. You can get away with just those tools, any additional specialty tools is just preference, like ball joint separators, etc.

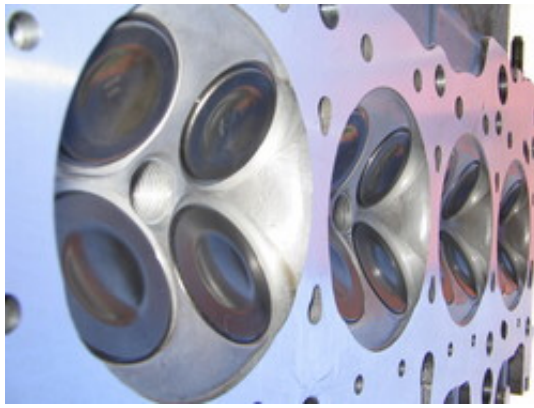


The head.

Let's first start off with your choices. There are B16 heads, ITR heads, and GSR heads. IMO, it is never worth buying an ITR head, if you plan on upgrading the springs/retainers/cams anyway. They are amazing heads from the factory, but B16/GSR heads can be had and built for far less. ITR/B16/92-93 heads are built from the same exact casts (PR3), while 94+ GSR heads are built from a different cast (P72) which is why the intake manifold bolt pattern is different (from here on, 92-93 GSR heads will be referred to as B16 heads). ITR heads have a slight hand port job on the intake side from the factory. They also have stiffer dual valve springs, as well as slightly higher lift/longer duration cams and lighter valves. If you want to make more than 200whp with your Isvttec build, you are going to need better cams and springs/retainers anyway...so do you see why it's just not worth the \$1000-1200 price tag on used ITR heads? The question you SHOULD ask is, should you get a GSR or B16 head? Tough question. Here's the deal...B16 heads share the same bolt pattern as ITR's for the intake manifold. They are easier to find aftermarket intake manifolds for than GSR heads. However, GSR heads have a distinct advantage over B16/ITR heads. Although having slightly smaller combustion chambers that raise compression is an advantage, it is the reason why it raises compression, that is the REAL advantage. You see, GSR heads employ small flat surfaces on the edges of the combustion chamber called "quench" pads. This does raise compression, but the real advantage is this design's ability to ward off detonation. So, if you decide you want a GSR head, it shouldn't be for the higher compression it will give you, but for the ability to run higher compression with it, safely. Beware though, if you plan on running a GSR head with CTR pistons, there is not much room for mistakes. The clearances are tight. I wouldn't personally run that combination w/ stock cast pistons anyway. So keep that in mind. Now that you can see the advantages of both heads, it's really a toss-up. It's your decision, go with the one that fits your needs.

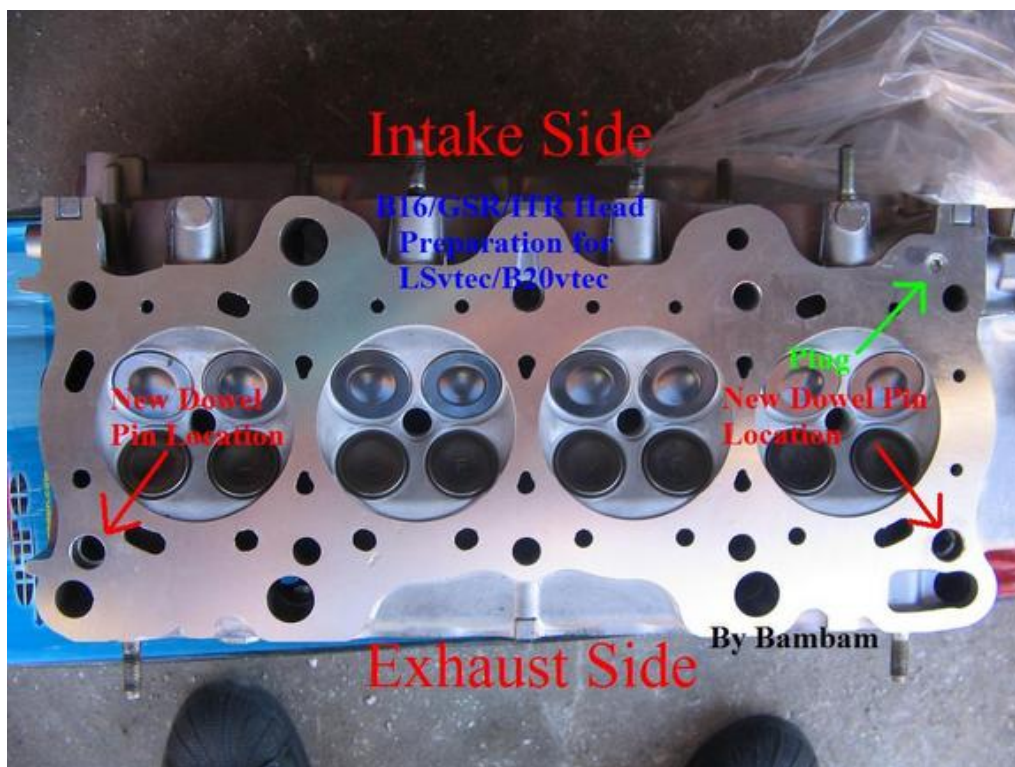
Now, if you have the money, and you want to build a powerful setup, I highly recommend sending your head out to one of the proven head porting shops out there like RLZ, portflow, DonF @ DFE, Headgames, Import Builders, or Alaniz. I would also go ahead and at the very minimum pick up new OEM valve seals, if not aftermarket. These are equivalent to piston rings for the head, as they seal oil out of the combustion chamber. Don't worry though, Honda valve seals are still fine. Valve springs and retainers are also a mandatory upgrade if you ever plan on making power passed 8k with your Isvtec w/ upgraded cams. Some great companies are Rocket Motorsports, supertech, omni, RLZ, Import Builders, JG, etc. I went ahead and milled the head a little just to freshen the surface. It is by no means necessary. But, keep in mind that if you do it, your cam timing may be slightly affected, as well as your piston to valve clearance and compression ratio. Be careful how much you take off. Here are pics of my '00 B16 head fresh from the machine shop:





Vtec head preparation.

First, you must remove the allen plug on the intake manifold passenger side of the head. Heating it up with a torch may ease in the removal of this plug, although I've never had to use heat, just muscle. Next, you must tap the head and install the 1/8 NPT pipe fitting included in your Isvtec kit you either purchased or assembled. Make sure to either teflon tape/paste it or use threadlocker, which ever you prefer. I use teflon tape myself. For the dowel pin holes, I used the two corner exhaust side head bolt holes. They fit perfect with the golden eagle Isvtec dowel pins.



Now, on to the block.

The stock LS pistons are garbage, unless you plan on turboing this setup, get rid of them. Even in which case, I personally wouldn't boost more than 10 psi on the stock sleeves/pistons, and that's with extensive tuning. I suggest getting aftermarket forged pistons/rods, although it is by no means necessary in an all motor build. Stock cast honda pistons are more prone to detonation than aftermarket pistons. They have been used time and time again reliably. But reliability isn't anything more or less than the tuning that is done after the initial startup. If you do decide to go with aftermarket forged units, be aware there are still many options. Your main options are high or low content silicon pistons. Low silicon pistons expand alot during warmup, causing "knocking" noises. They also tend to burn a little more oil because of this. Your other option is High content silicon pistons. These pistons are somewhat in between cast and and high silicon forged pistons. They do not expand nearly as much as low silicon pistons, but the higher content of silicon makes them not as strong. It's up to you to do the research on this.

As for the rings, use whichever you prefer. I swear by Hastings piston rings myself on cast pistons and I personally wouldn't use anything other than them or OEM honda rings. But, if you use forged pistons, use whichever rings they include or recommend. Everyone who is anyone will now agree, that it is MANDATORY that you install ARP rod bolts. LS rod bolts are the same exact rod bolts that come factory in sohc dseries motors. This is THE single point of failure on LS blocks. It's not the rods, or anything else, it's the rivet sized rod bolts.

Upgrade to ARP rod bolts! Now for the rods, if you plan on staying with the stock rods, which is perfectly fine, it would be smart to shotpeen them. This will improve the tensile strength of the rod. Just a small piece of mind when you're at 9k. Some shops charge extra for this, some include it with their rebuilds...but either way, it's cheap so do it. You should also have your rod's journal's (big ends) resized when you install ARP rod bolts. A lot of people will say it's not necessary, but ARP recommends it. Pay the extra few bucks to have this done, again for peace of mind. ARP doesn't make any money off of this, so why do they recommend it? Because the extra torque placed on the rods using their rod bolts has the tendency to "warp" the big end of the rods. It's not a difference you can see with the naked eye, but it's there. As for bearings, go with whatever you prefer. Some swear by OEM honda, but if ACL's are within standards, there's nothing wrong with them. ACL is better if they are within clearance specs because they offer a trimetal design much like oem GSR/ITR/CTR bearings are. I would also go and get the rotating assembly balanced. Again, not mandatory, but it helps in the high revs. A lot of people like to use girdles. It makes sense right? B16's and B18C's use them, and honda implemented them for a reason right? I agree totally. But I'm a fan of "keep it simple". There are plenty of people running girdled blocks revving to 9k or higher. I don't use one. But, you decide. There are about a million other things you can do to the block. Don't buy into gimmicks, and keep it simple. Simple = less shit to go wrong. If you are unsure of all the options you have with building a block, talk to a well known engine builder. There are plenty of them here on hondaswap.com. And, if you can get into a conversation with one of them, I'm sure they can clear a lot of things up for you. Now, here are pics of my block fully assembled (P30 pistons and rings installed, cylinders honed, shotpeened LS rods, arp rod bolts installed, rods resized, crank balanced, polished, and knife edged:





ARP head studs installation.

Another near mandatory upgrade. The ones you need for this hybrid setup are the GSR/ITR studs/bolts. Do NOT use the B16 or B18a/b studs. They are the incorrect length. First and foremost, make SURE that the holes are clean and clear of debris. The best way to do this is to spray brake cleaner or intake/carb cleaner down the holes, and use compressed air to blow out the cleaner and debris. Make sure to cover up the cylinders so that crap doesn't get into them though. Make sure to lube up both sides of the studs w/ ARP moly lube (which is included with their bolts), or with 30w oil (Not 10w30, but solid 30w), if you bought them used. Tighten the ARP head studs all the way down with an allen wrench, then back them off about a 1/4 turn (ARP recommends they are hand tight, and this is equivalent). But, beware. When they say handtight, they do not mean tighten them

down with your hand. This is just silly because you can't thread the studs all the way down by hand; they won't all be even. What they mean is, thread the studs all the way to the bottom, but do not have the bolts applying any pressure to the block (no torque). You can also use the double nut technique, which is just putting two nuts on the stud, and using a socket or box wrench to tighten the upper nut. This will turn the stud because the lower nut will hold the upper nut in place. This will ensure that they are all at equal height. Do NOT torque the studs INTO the block. This will negate the whole reason you are using studs instead of bolts in the first place. The advantage of studs is this...the block will be "pulling" down on the head, which is the opposite force of combustion, as opposed to the head "pulling" up on the block, in the same direction as combustion, which is what the stock head bolts do. The studs help create a better seal.



Next, I install the oil pan gasket and oil pump.

It's simple; you just remove all the 10mm nuts from the oil pan. Now, remove the oil pump by removing the mounting bolts. Make sure to clean both the block and oil pan mating surfaces so that there will not be any leaks. Also, clean the oil pump mating surfaces. Use brake cleaner or intake cleaner for this. I also used this time to fully clean out the oil pan free of debris and oil with soapy water. Make sure it is completely dry before reinstalling it. At this time, you should also install your new oil pump. Now, the next step is not necessary, but most engine builders do this and I do it as well. You should prime the oil pump; and you do this by packing it with petroleum jelly on the inside of the pump gear. Now, spread a good layer of high temp RTV on the block and oil pump mating surfaces. Then, reinstall the oil pump and pick up tube, as well as the windage tray. Torque everything to spec. Slip on the oil pan gasket and then the oil pan. Install all the 10mm nuts to spec.

Water pump installation.

It would be to your advantage if you went out and purchased an OEM ITR/GSR (P72) water pump. But, if you use this water pump, you must

also use the ITR/GSR (P72) timing belt. If you use the LS water pump, use the LS timing belt. The P72 water pump has 22 teeth as opposed to the 19 teeth on the LS pump. This means the GSR pump spins slower at higher RPM's, and vice versa. You may think this is bad, but it is good, because at those higher RPM's with an LS water pump, you will theoretically be spinning the pump so fast, that it doesn't even push water; it just creates bubbles (cavitation). Get it? Ok, so take your water pump now and spread a bead of RTV in the gasket groove, and then slip in the gasket. Bolt up the water pump and torque down to specs. Tighten them down in a criss-cross pattern as you would lug nuts. Do not over tighten as you can warp the pump or crack it, possibly even strip the bolts. Bad.





Water pipe installation.

Slip on the two rubber seals on both ends of the pipe. Slide one side of the pipe into the opposite side of the water pump. The other side gets installed by sliding it in with the thermostat housing installation.



Thermostat housing installation.

Slide the other end of the water pipe into the thermostat housing. Bolt the thermostat housing down with it's two 10mm bolts. Torque to specs.



Now time to install the fan switch, oil pressure switch, and knock sensor.

This is self explanatory. Just tighten them down till they can't be tightened down anymore. As for the knock sensor, you need to tap

the right hole of the upper alternator bracket, if you plan on running one. You must first drill the hole out with an 11mm drill bit or equivalent. The knock sensor is 12mm x 1.25, so that's what you have to tap the hole with. Grab the tap from your local hardware store. Tap the hole and screw in the knock sensor. This is completely optional. If you like check engine lights flashing on your dash, then skip this step. I however don't. Even though I installed it and have it wired in, I have it disabled through my engine management software. This forces the computer to run in my manually created ignition maps. Don't disable the knock sensor unless you have experience with ignition tuning.



Breather box installation.

96+ LS blocks won't have this, which is why it is better to use the 90-95 LS blocks. Now think about it. Does it really matter how many miles the block you are using for this build has? No, because you are going with new rings/bearings/hone anyway, right? But, use common sense for this. Get the cheapest 90-95 block you can find. If you are building a B20vtec however, you will have to buy one if you plan on running one. Z10 motorsports and Endyn both make nice kits for you. This is not mandatory, but I highly recommend it. If you don't have this breather box or an aftermarket one installed, your Isvtec motor will develop extremely high crankcase pressures, which is no good. Make sure the little rubber o ring is on the box, and pop it into the equally sized opening on the back of the block. Torque down the single bolt on the bottom till it is tight. Done.

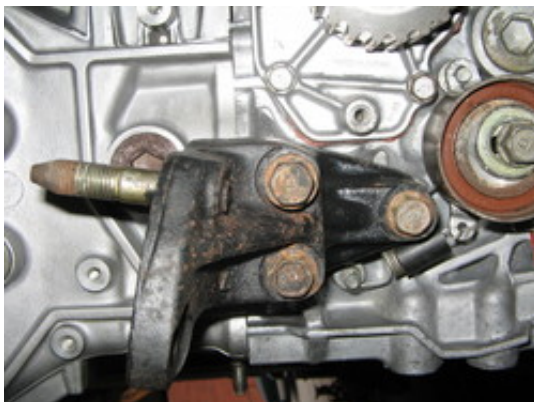


Alternator brackets installation.
Again, self explanatory. Tighten till tight, duh.

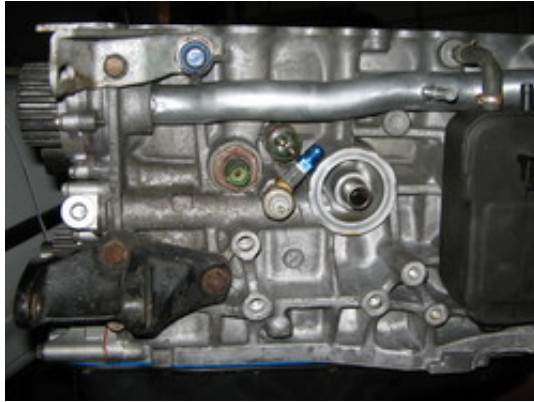
Time to install the tensioner pulley.
Make sure to align the spring properly. Then, bolt the pulley down.
Don't tighten it all the way just yet, we will need it loose to install the timing belt later.



Last thing to do to the block before we install the head...install the driver's side engine mount bracket. Another no-brainer. Tighten the 3 bolts down till they are tight. It may be to your advantage though to keep them a little loose to give you some room in installing this Bseries into your smaller honda chassis, especially if you have an EF (88-91 civic/crx) chassis like I do.



Block now fully assembled:



Now, we need to begin with the head installation.

Make sure you have already installed the oil galley plug into the head and that it sits flush, this is imperative to redirect the oil flow via the external oil lines to activate vtec. A lot of people complain about oil leaks with Isvtec setups. You ask them if they installed this plug and they ask you "what is that"?.....just turn around and walk away. Ok, now the very first thing you need to do is set the block to TDC. This means setting the 1 and 4 pistons to the very top of their stroke. This will aid in the ease of the installation of the timing belt later. You can do this by putting on the crank pulley bolt and tightening it on enough so that when you rotate the crank counter clockwise, it will not come loose. Always rotate the crank counter clockwise! The motor does not naturally spin clockwise, so do not force it to spin that way. Now, there is a mark on the crank gear as well as an arrow on the oil pump. Align the crank gear to this small arrow above the gear and you will notice that the motor becomes set to TDC when the marks are aligned. Now for the head installation...begin by sliding the LS/CRV (90-01 LS or 96-00 CRV, whichever block you have) head gasket over the head studs onto the block. Now install the dowel pins into the exhaust side of the head (for Isvtec motors). Slide the head over the head studs and rest on the block. Make sure the dowel pins line up as this is critical. If the head needs a little persuasion, tap it with a rubber mallet. Next, slide on the ARP washers and nuts. Torque them down to ARP's recommendation (70 ft/lbs on GSR/ITR studs, which is what you use for Isvtec's), not honda's, using the ARP moly lube. But, follow honda's recommended torque sequence. If you bought the studs used, and if you can't find ARP moly lube, use solid 30w oil (not 10w30). If you do this, torque the studs down to 80 ft/lbs, as per ARP's instruction. To torque the head down, you do it in 25 ft/lb increments. First 25 ft/lbs, then 50, then 70 (if using ARP supplied moly lube), or to 75 and then 80 (if using 30w oil). After you torque to the final torque value, go back and retorque in the proper order, to

the same final torque value (70 or 80 depending on what lube you use). I like to add 2 ft/lbs to all my head installs because I know they are going to be abused and because I know not every torque wrench is calibrated perfectly. So, in my opinion, you should torque your head to 72 ft/lbs to be sure. Head installed and torqued down:



Installing the vtec solenoid housing and both coolant temp sensors. Tighten the coolant temp sensors down until they are fully threaded and tightened; easy enough. The single pin sensor is the sensor for the coolant temp in your gauge cluster, whereas the two pin sensor is used by the ecu to read engine coolant temp, and dictate air/fuel ratio. Torque the solenoid's 10mm bolts down to spec.



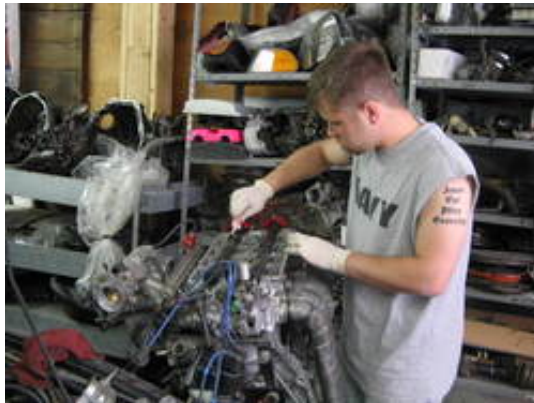
Coolant housing installation.

Pretty simple; spread a thick bead of RTV where the housing bolts to the head. Torque it's 10mm bolts down to spec.



Installing the cams and cam gears.

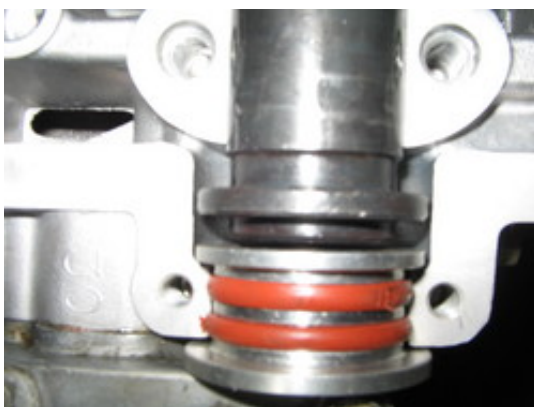
Be careful in choosing cams. GSR cams are great for a stock compression LS block. ITR/CTR cams are also a great upgrade if you can get them for cheap. I believe it's necessary to run AT LEAST ITR dual valve springs with these cams, however, there are some that don't and get away with it. I would caution this though, as I've personally seen two separate motors drop a valve at high rpms with ctr/itr cams w/ stock b16 or GSR valve springs. Other than that, any set of cams you decide to go with is going to require higher compression to make any amount of power. I suggest AT LEAST 11.5:1 compression, if not higher in the 12:1-12.5:1 range (but don't forget to clay your motor for piston to valve clearance). There are plenty of great cams to choose from out there on the market. I would keep it simple and go with the proven cams like Skunk 2 stage 2/3's, Skunk 2 Pro 1's, Rocket M22x's, Buddy club spec 3/4's, Toda B/C's, or Jun 3's. All of those cams are AROUND 12mm of lift, plus or minus a little, with varying duration specs. This is a good size cam to start with. Tuning will be key to how much power you make. On to the installation. First, make sure you slide the two rubber cam seals that go on the end of the cams behind the cam gears. Then, slide the cam gears onto the cams. Make sure to properly align them with the small woodruff keys, as it is very easy to misplace. Tighten down the cam gears until they cannot be tightened any more. Now the cams. Make sure to apply a GENEROUS amount of assembly lube /cam lube to all the cam lobes and the journals on the cams. This is VERY important. Make sure the cam with the slot on the end goes on the intake side. That slot is for the distributor. Then lay the cams in their respective positions. Here, I am installing a set of Buddy Club Spec III cams:





Cam seal.

This one goes at the end of the exhaust cam shaft on the passenger side. Stick it in. Done. (nice shiny one from azracemachine.com)



Installing the cam caps and cam rails.

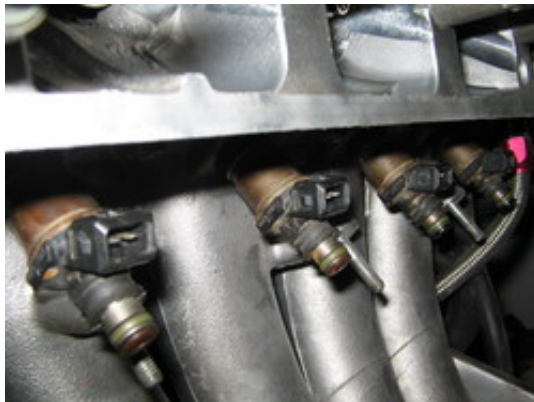
Make sure they are both clean and free of debris. Don't be frightened as to which ones go into which spots. Conveniently, they are all labeled. They have either an "I" or an "E" on them for intake and exhaust. The caps are also labeled with numbers. Start with "1" on the timing belt side and go from there. On the timing belt side, you must place the cam seals that are behind the cam gears, underneath the first cam caps. These are there so that oil does not leak out from under the cam caps and behind the cam gears. Next, place the rails on the caps. If you look at the underside of the rails, you will be able to see where they lined up with the cam caps to see which one is the intake rail and exhaust rail. Some rails also are stamped with a very faint "I" and "E", but this is not always true. You'll have to see for yourself to know what I am talking about. Now, lube up all of the bolts with 10w30 oil first before you install them as per Honda's guidelines. Torque the 12mm's down to 20 ft/lbs and the 10mm's down to 7.2 ft/lbs; follow Honda's recommended sequence. Make sure those rubber cam seals stay underneath the first set of cam caps. Installed:

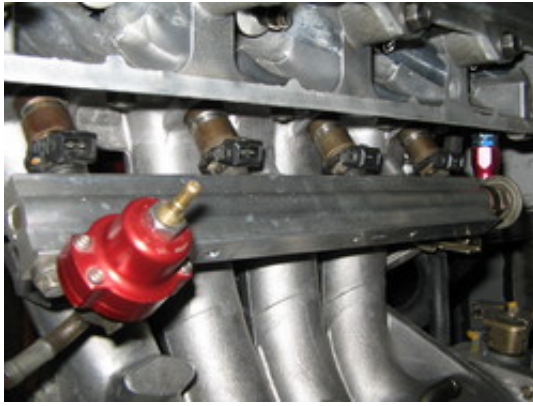


Intake manifold, injectors, and fuel rail installation.

ITR/B16 intake manifolds use the same bolt patterns, but GSR heads use a totally different bolt pattern so you must use a GSR intake manifold with them or aftermarket equivalent. I chose to use an ITR intake manifold and the larger ITR throttle body because they just dominate the B16 manifold past 6-7k. But, on the downside, as a general rule, the B16 manifold makes more power upto 6-7k. It just really depends on where you plan on making power. This would also be a good time to buy one of those nice cooler intake manifold gaskets that hondata and passwordjdm make. It is not necessary, but are good for a 1-2 HP increase for only \$35-60 which is well worth the money. As for the injectors, contrary to popular belief, ALL Honda B and Dseries motors use the same size injectors (240cc). So, it doesn't matter if you use 92 civic dx injectors or 01 jdm integra type-r injectors, or anything in between, they're all the same size (except i think HF or CX injectors, correct me if I'm wrong).

Now, align the intake manifold gasket onto the head. Torque down the intake manifold's 12mm to spec. Install the injectors with their rubber gaskets. Then, install the fuel rail. Stick with stock on this, I've seen more problems with casting flaws in aftermarket fuel rails, than you'd care to deal with. Stock honda fuel rails are good for over 500 HP, so don't worry. Remember, keep things simple. Make sure not to over-tighten the 10mm nuts holding the fuel rail on. Injectors - I would suggest AT LEAST 310cc injectors for a build reaching 180 whp or more, although it is proven to not be necessary. You will just need to run the stock injectors at an extremely high and inefficient fuel pressure, which would require you to own an FPR to adjust the fuel pressure. Keep in mind, higher fuel pressures are bad for fuel atomization so it's best to run larger injectors in the 40-50 psi range. The stock injectors below are for visual purposes only.





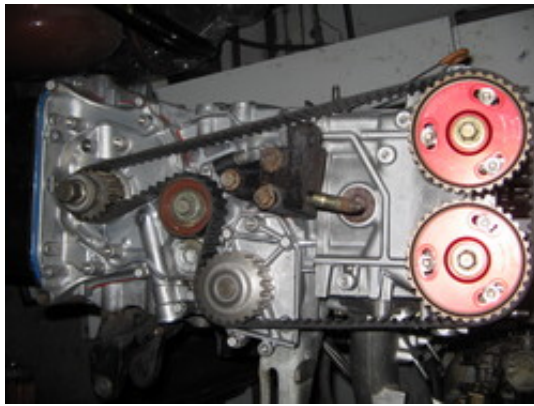
Now that the head is installed, we may install the oil line and timing belt. Follow the instructions included with your Isvtec oil line kit, as every kit is different. But, what ever you do, don't forget to teflon tape all fittings! The kit I am using is from full-race.com and is a proven kit. It replaces the factory oil pressure sending unit with a "T" in which the unit and oil line are screwed into. It's simple, and that's why I like it. I like the Golden Eagles oil sandwich adapter, but they include the wrong head gasket in there kits, which is why I will never use one.





Installing the GSR/ITR timing belt (Or LS timing belt if using the LS 19T water pump).

Re-verify that the block is still at TDC. Now, rotate your cam gears until the timing marks are aligned (consult your manual for further illustrations and guidance). Once the crank and cams are aligned, you can now install the timing belt. I like to start with sliding it over the cam gears, then work it down over the water pump and tensioner. Then, take the tensioner and pull down on it until it is fully loosened and tighten the 14mm bolt so the tensioner is tightened in the fully loosened position. Slide the belt over the tensioner now and then the crank pulley. Easy. Now, loosen the tensioner with the belt on. Then, use a flat head screw driver or something of the like and use it to wedge the tensioner pulley up while you tighten it's 14mm bolt. Now the belt is tight. But, do not overtighten it as this can cause strain on the motor. Follow your manual to find out how much play (deflection) is recommended.



Now we can install the lower timing belt cover, crank pulley, alternator and alternator belt. The LS cover will need to be trimmed to fit over the newer oil pump. No biggy. The cover slips on over the crank gear. Tighten all of it's 10mm bolts down tight. Then slide over the crank pulley and make sure to install another one of those pesky woodruff keys. Tighten the crank pulley bolt down to specs. An impact gun will tighten it just fine. Slap the alternator on it's brackets. Don't tighten it down just yet. Slide on the belt, and push out the alternator with a pry bar or the likes. Tighten the upper and lower alternator bolts now. Please do NOT ever use a broken/cracked/chipped crank pulley. It will throw off the balance of the crankshaft and can be detrimental to the oil pumps operation. This would be especially dumb if you paid to get your crankshaft balanced, as I always do, because it would throw off the balance again. The crank pulley installed below is for visual purposes ONLY.



Distributor.

Align the inside marks on the back of the distributor (there are a few lines and marks, just line them up). If the motor is still at TDC, the distributor should go on and be timed perfectly. Tighten it's 12mm bolts down. If you are using an LS distributor, you will have to cut off the front mounting leg, as it hits the vtec solenoid housing, and only the upper bolt will line up. Be prepared for a very small oil leak if you do this (nothing to worry about though). This is not a problem

because internally, all obd1/2 distributors are identical (timing wise), it's just the mounting legs that are different.



Installing the valve cover.

First, make sure to replace all valve cover gaskets with new ones. Slap on the valve cover. Now, put on the grommets, then the 10mm nuts. Tighten them down until they are just past hand tight. Do not overtighten as these are easy to strip.



Last but not least, the spark plug and spark plug wires. If you are using the stock LS pistons, use stock B16 spark plugs. If you are running compression in the 10.8-12.0 range go with one stage colder spark plug (NGK BKR7E). If you are running over 12.0:1 compression as I am, run the two stages colder NGK's (#7173, pictured below). You can get away with the 1 stage colder NGK BKR7E, but that's your choice to make. If you get any detonation, go with the next stage colder. Going to a colder plug isn't going to cause a power loss either. First, gap them to the desired range. You want to have as large as a gap as possible until the ignition can't bridge the gap, which is why it's good to increase the gap with aftermarket ignitions, to achieve it's full spark potential. A good gap to start with is .44. At this time, you may apply a thin coat of anti-sieze to the spark plug threads. Install the spark plugs with a spark plug socket, or 16mm deep socket. Tighten them till they stop. Do NOT overtighten. As for the spark plug wires,

start with the first cylinder (timing belt side) and work your way to cylinder #4. The firing order is 1,3,4,2. It always is with 4 cylinder hondas. 1 is the top right corner of the rounded side of the distributor cap (look at the cap you'll see what I mean. There's a rounded side and a square side). Plug in the wires going clockwise from there using the correct firing order I gave you. Done.



Now, the engine is fully assembled!



Initial startup process for new cylinders/rings:
Fill the motor up with 30W non detergent oil (quality does not matter). Just buy the cheapest you can find. Also, pick up the cheapest oil filter you can find (usually Fram). Check the dipstick

periodically to see when the oil pan is full. Try not to fill higher than the upper most dot on the dip stick. It should be around 4 quarts (remember, you need a little extra oil for the vtec oil line).

Fill the motor with a 50/50 mixture of coolant to water. Believe it or not, the more water this mixture has, the cooler the engine will run. But, you need antifreeze in colder climates to prevent coolant freeze/expansion, as well as to prevent the water pump and sleeves from corroding.

Now, disconnect the ecu and turn the motor over for roughly 30 seconds to build up oil pressure. This is the easiest way to ensure you will not be injecting fuel and spark into the cylinders. Reinstall the ecu you will be using.

Fire the motor up and check for leaks. Make sure the oil pressure light extinguishes immediately. If not, turn the car off and troubleshoot. Let the car reach full operating temperature.

Immediately begin to tune the car for a 14.1-15.1 AFR. The closer to 14.7:1 the better. That's it. For the rest of the tuning, I'd suggest a street tune first then tune on the dyno, but every tuner has his/her own ways.

Oil changing schedule:

Initial - 30w non detergent

after 20 miles - 30w non detergent

after 100 miles - your favorite non-syn

after 500 miles - your favorite non-syn

after 1000 miles - your favorite non-syn/synthetic

You should stop seeing metal shavings in the oil after the 100 mile oil change. I strongly recommend using a magnetic oil drain plug for freshly built motors. You don't want all those shavings being pumped to the bearings, cams, or splashing on the cylinder walls...bad. Don't worry though, they will be there, no matter how close the clearances are.

Now for the break in, try to vary the revs as much as possible, with a lot of short blasts. It is very important that you let the engine "brake" itself by just letting off the throttle and letting the vehicle slow down on it's own, while in gear. This creates a vacuum in the cylinder and forces the rings outward, which wears down the peaks in the cylinder's fresh hone. Do this for the first 20 miles, and then proceed to beat the shit out of the motor, up to it's maximum rev range, as long as it is tuned accordingly. As long as the bearings are within spec and the rod bolts were torqued correctly, there is NOTHING to worry about.

I guarantee you WILL NOT burn oil using this break in method. If you

do, you probably have leaky valve seals or bad rings/cylinder hone, or maybe possibly even other major problems with alignment of the sleeves themselves.

-bambam

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2.jpg
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3.jpg
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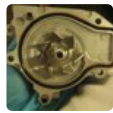
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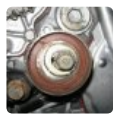
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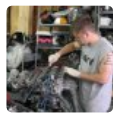
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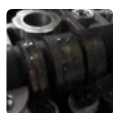
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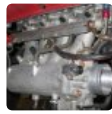
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Last edited by a moderator: Jun 15, 2015

bambam, Jul 2, 2006

#1

Mdawson98 likes this.



pissedoffsol

RETIRED

Messages: 49,693

Likes Received: 50

Joined: Sep 28, 2002

Location:

Retirement Home

great article, but yes, the pics will be a problem.

if you still have the orig's, you can use the attachment system here to upload photos right to the post.

pissedoffsol, Jul 2, 2006

#2



I do still have all of the originals...it's just going to be a PITA to upload 50 img's.....

bambam, Jul 2, 2006

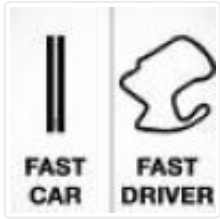
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bambam

Member

Messages: 31
Likes Received: 1
Joined: Jul 11, 2004
Location: groton, CT

images updated to attachments for speed.



Briansol, Dec 5, 2010

#4

Briansol

Admins

Admin

VIP

Messages: 21,199
Likes Received: 1,993
Joined: Nov 18, 2007
Location: CT

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