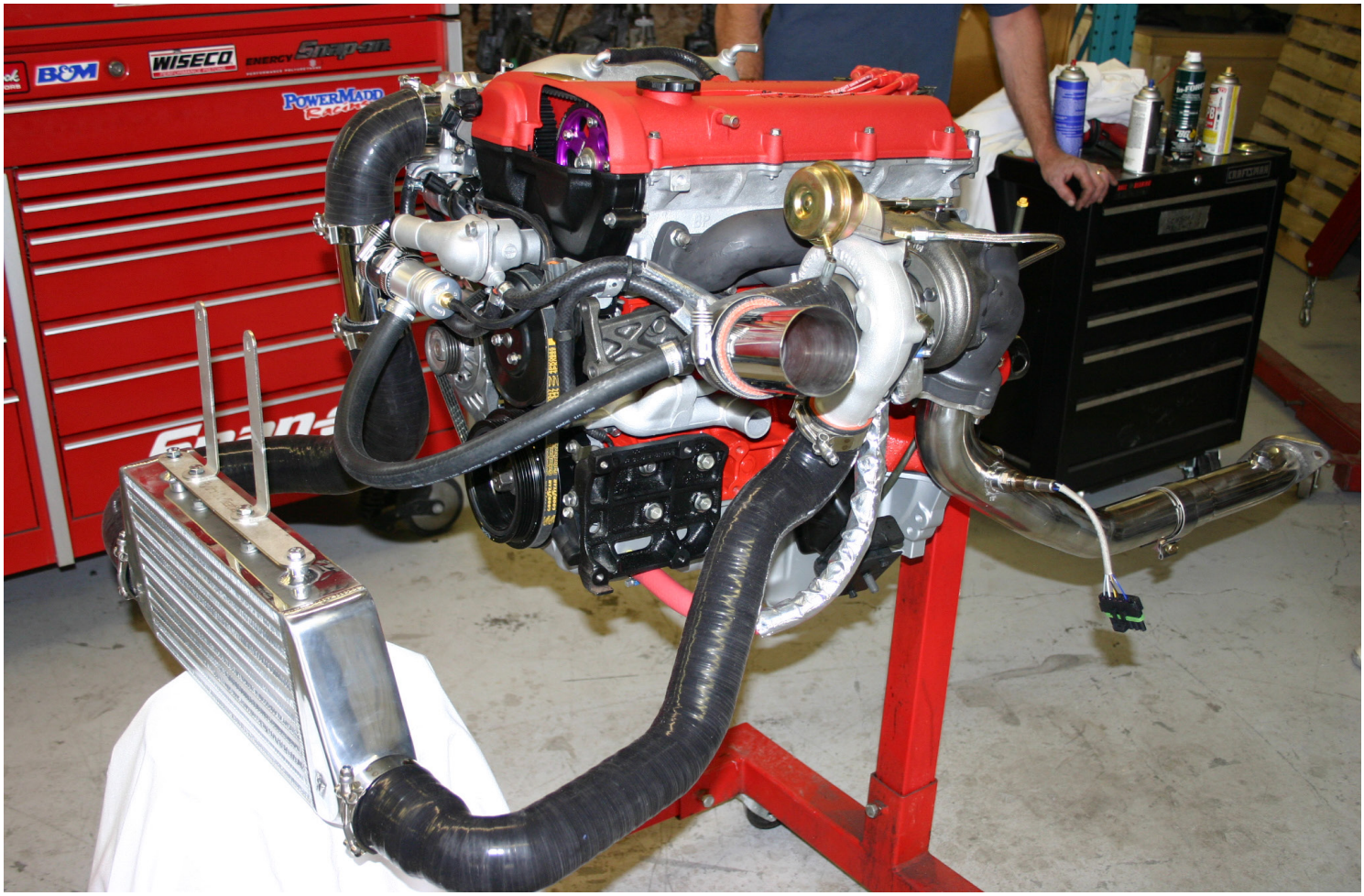
Flyin' Miata

FM Custom Turbo Kit
Installation Instructions
22-1XXXX



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Rev 7.1

Introduction

Thank you for purchasing the Flyin' Miata turbo system. We regard the installation as a mutual project and will be pleased to offer help at any time. We remain committed to make this a successful and enjoyable experience for all concerned. These instructions will offer the installer a guide for the installation and operation of the Flyin' Miata turbocharger system for the first and second generation ('90 - '05) Mazda Miatas. Any instructions that don't apply for all years are clearly marked.

STOP!

DO NOT DEVIATE FROM OR SKIP ANYTHING IN THESE INSTRUCTIONS UNLESS YOU TRULY UNDERSTAND EVERYTHING ABOUT WHAT YOU'RE DOING. WHEN IN DOUBT, CALL US. INCORRECT DEVIATION COULD BE A VERY EXPENSIVE MISTAKE.

Please read through these directions entirely. Evaluate your own skills honestly and decide whether this installation is something that you are comfortable doing. Realize that you are significantly increasing the horsepower of your car and the consequences of improper installation could destroy your engine. To install this kit safely, you must have a firm grasp of how cars work. Proper tool use is critical. We are more than willing to help anyone install this kit, but you must be honest with yourself with respect to your skill level before you jump into the deep end. These directions do give you a step-by-step process to follow, but problem solving and critical thinking are still required. If you have any concerns, either discuss the process with us or pay a professional to do the installation.

We know there are a lot of words in this manual - we're sorry, but they're all very important words. **PLEASE READ EVERYTHING.** Don't skim, actually read the entire thing - ***before*** you start the installation. We're happy to help, but we'd rather not read the instruction manual back to you.

The success of this installation will be determined by a variety of factors. The vehicle must be in excellent condition and in proper tune prior to starting the installation. Do not attempt to install this kit on a car that is not running properly. Before installation, fix any problems. This will help prevent our kit getting blamed for pre-existing conditions. Care and attention to detail by the installer are of extreme importance. The daily operator of the vehicle must observe all operational guidelines. For specific torque values, refer to the service manual that's called out in the "Tool and Equipment Requirements". Use high-temp anti-seize on any bolts that don't specifically call for other thread treatments.

Inventory all the components when the kit arrives. We strive to ensure all the components are included in the kit, but if a part is left out you will want to know it before you are looking for it during the installation. Plus, this will allow you to familiarize yourself with the parts in the turbo kit. Since our turbo kits can be customized in many ways to suit your needs, not all kits will come with the same parts. Please refer to your order confirmation email for the list of parts that make up your specific turbo kit. Also note that several of the parts included are kits themselves. Each of these sub-kits will come with a paper copy of the list of parts that they include.

Prior to starting the installation, go through two tanks of the highest octane fuel available. Do not dilute with lesser octane fuel already in the tank. If necessary, drain the tank. Using lower octane fuel will result in knock that could damage the engine. All left or right directional references are from the driver's viewpoint. If clarification of these instructions is required, please contact us at 970-464-5600 or via e-mail at support@flyinmiata.com. Suggestions for improvements of these instructions are welcome. Please make notes on the instruction set and mail to: Flyin' Miata, 499 35 Rd, Palisade, CO 81526.

These instructions and the operational requirements for this system must be reviewed with the driver.

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Tool and Equipment Requirements

Every project on your Miata presents the opportunity to purchase more tools. Below are the tools you will need for the successful installation of this turbo kit.

metric open/box end wrenches
metric socket set
clean rags
assorted slot and Phillips screw drivers
metric allen wrenches
Teflon thread sealant paste (NOT tape)
floor jack
jack stands x 4
one quart of mineral spirits
hammer
JB Weld (optional)
eye protection
grease
funnel
long (18"+) extension (optional)
high-temp anti-seize
oil filter and fresh high quality synthetic oil
spray can of cleaning solvent
hacksaw
hand drill with ½" chuck
silicone sealant ("The Right Stuff" is best)
Loctite (blue)
factory shop manual or equivalent
duct tape
Penetrating oil ("PB Blaster" is best)
marker/paint pen
touch up paint/nail polish
electrical tape
razor blade
vise (optional)
universal joint (for your ratchet) (optional)

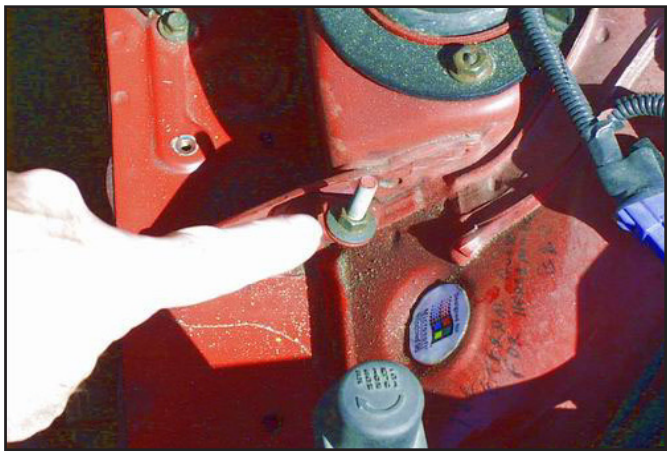
Preliminary

1. Again, be sure that the car is running properly and all of the maintenance is up-to-date.
2. Raise the car and support with jack stands.
3. Drain the coolant. There is a drain plug in the center of the bottom of the radiator.
4. Drain the motor oil. Install the new filter (NOT the new oil) and temporarily reinstall the drain plug.
5. Disconnect the battery.
6. **DON'T OVER-SPIN THE TURBO!** Carefully spinning it by hand is okay, but shooting an air nozzle from an air compressor at the impeller isn't. The turbo can handle very high rpm with oil pressure (i.e., when the car is running), but without oil pressure you will permanently damage the turbo.

Acronyms:
IAC - Idle Air Control (valve)
O2 - Oxygen (sensor)
WBO2 - Wideband Oxygen (sensor)
ECU - Electronic Control Unit (computer)
AFM - Air Flow Meter ('90 - '93 cars only)
MAF - Mass Air Flow (sensor) ('94 - '05 cars only)
BOV - Blow-Off Valve (or bypass valve)
NA - '90 - '97 Miatas
NB - '99 - '05 Miatas
NPT - National Pipe Thread Taper
CAS - Cam Angle Sensor (90-97 only)
AFR - Air:Fuel Ratio
MSM - Mazdaspeed Miata

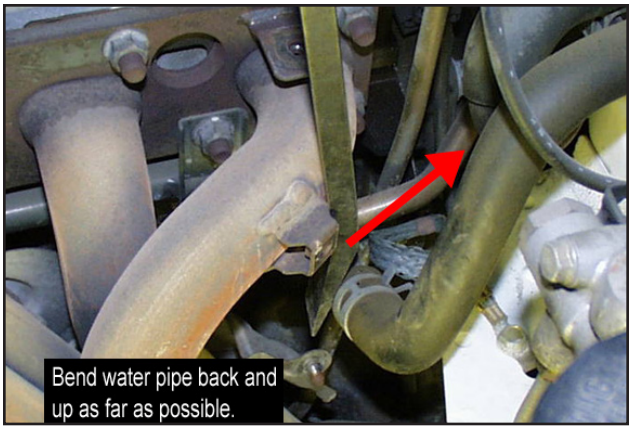
Disassembly

NOTE: If you're removing the transmission anyway, it's typically easier to install the EGR tube while the transmission is out. You should install the turbo at the same time, as the EGR needs to be fastened at both ends (exhaust and intake manifolds) at the same time.



1. Remove the dipstick from the dipstick tube. You don't need to remove the dipstick tube. You won't actually need to do anything with the dipstick, but there's a good chance that it could be accidentally broken during the installation. Plug the hole to ensure nothing slips down there.
2. Remove the entire intake assembly, including the intake snorkel, air filter box and the crossover pipe between the MAF / AFM and the throttle body. The IAC hose won't be reused but also needs to be removed. The IAC hose is the small hose that runs from the IAC (underneath the throttle body) to the crossover pipe.
3. **'90- '97 Cars Only:** Remove the metal bracket that supports the air box from below and the stud (in the picture above) that locates it on the outboard side.
4. **'90 - '97 Cars Only:** If so equipped, remove the cruise control unit from the inner fender and remove the gold colored brackets that mount the unit to the car - these brackets will not be reused. Do not disconnect the cable! Set the unit in the area below the windshield until we are ready to mount it again.
5. From the air filter box, remove the mass air meter (MAF) / air flow meter (AFM). This will be reused. Do not touch the sensing element on the MAF (the AFM works with a flap / door and isn't as sensitive).
6. **'99 - '05 Cars Only:** Remove the intake air temperature sensor and its rubber grommet. Remove the relays from the plastic divider behind the driver's side headlight, then remove the plastic divider itself. Let the relays hang loose for now, they will be remounted later. The plastic divider won't be reused.
7. Remove the rubber/chrome hose that runs from the driver's side of the cam cover to the intake pipe. It will not be reinstalled so the two retaining clips/bolts can be removed from the front of the cam cover as well.
8. Remove the exhaust manifold heat shield. These bolts will be old and rusted in place, so soak them down with penetrating oil before trying to remove them. We don't reuse them, so it's not catastrophic if they break. After the heat shield is off, spray the nuts that hold the manifold to the head and the oxygen sensor with penetrating oil. We will be reusing these parts, so be careful with them. The studs will often come out of the head, as opposed to the nuts coming off of the studs. If this happens, try to remove the nut from the stud. Soak in penetrating oil as long as possible, then grip the stud at the shoulder and remove the nut. The double-nut method (section 6, step 2) can be used if you have appropriately sized nuts (M10x1.25).
9. Remove the oxygen (O2) sensor from manifold - penetrant is a good idea here as well. Be careful removing it, as it will need to be reused.

10. **Before removing the exhaust manifold, bend the water bypass tube (located beneath the manifold, running to the outboard heater hose) back toward the firewall as far as possible (as shown). Use a large pry bar, prying against the manifold.**



11. Remove the exhaust manifold. Save the nuts, they will be reused to mount the cast manifold for the turbo. Plug the exhaust ports with rags.
12. Remove the lower splash pan and the black radiator inlet duct/mouth. The splash pan and mouth will need to be trimmed to fit around the intercooler and reinstalled.
13. Remove the bracket from the bellhousing that supported the factory downpipe. Re-install the bellhousing bolts. The bracket will not be reused.
14. **'01 - '05 Cars Only:** Remove the under car bracing to allow access to the exhaust. Pay attention to the different bolt holes in the brace, as some are slotted to ease installation. Therefore, it's not necessary to fully remove the nuts on those studs.
15. Remove the radiator hose between the lower outlet in the radiator and the inlet on the block. On '90 - '97 cars, there's a metal pipe between two rubber hoses, this needs to be removed as well.
16. The pictures below show the parts that will need to be removed from the different cars. Keep in mind that there may be extra parts in the picture, relative to your car and the kit purchased. For example, not all '90 - '97 cars will have cruise control to remove the brackets from. The stock injectors should NOT be removed. Some parts might be slightly different, as Mazda changed things throughout the years. You'll need to retain the MAF / AFM that's shown in these pictures.

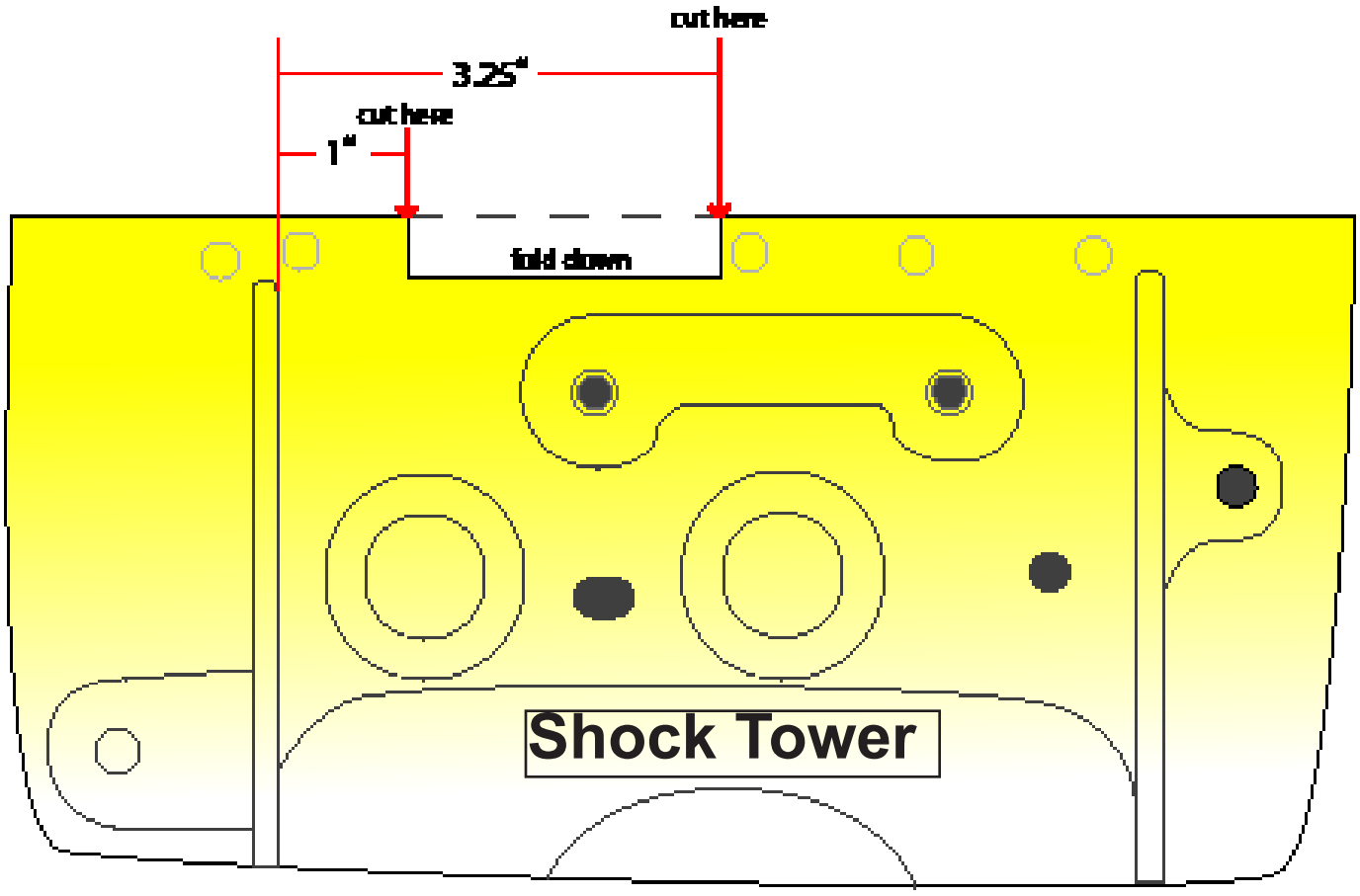
‘94 - ‘97

‘99 - ‘05

Slot frame rail lip

The orientation of the compressor on the turbocharger makes it necessary to slot the frame rail lip on the left side of the car. While this might sound intimidating, it's a simple process. Refer to the picture to get an idea of what the slot will look like and to clarify any dimensions specified. This method, versus one in which all three edges are cut, is used to preserve as much frame integrity as possible. Once the slot is done, finish the raw edges of the slot with some touch-up paint. If none is available, clear nail polish is a good way to protect the bare metal without worrying about matching colors. Be sure that the exhaust ports are plugged securely, we want to keep the metal shavings / dust created out of them.

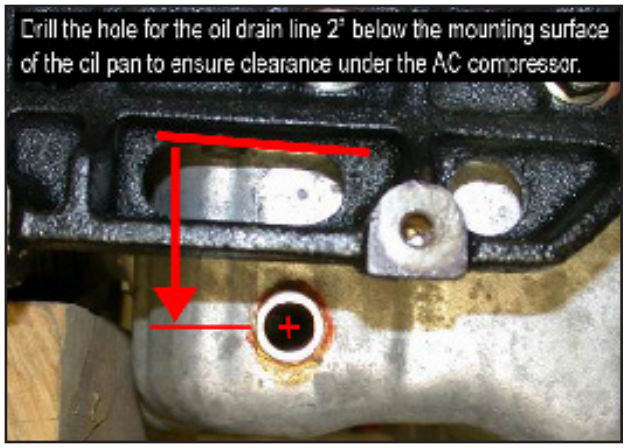
1. Cut two slits into the frame rail lip, running from right to left (passenger side to driver's side, up and down on the picture below). The slits need to be approximately 5/8" long. They need to run up to, but not through, the face of the frame going straight down. If you feel around underneath the edge of the frame rail lip, you'll feel the vertical face of the frame rail itself. The first cut will be 3-1/4" off of the forward shock tower brace, the second cut will be 2-1/4" from the first (towards the front of the car), or 1" off of the forward shock tower brace. For the small GT2554R turbos, the slot needs to be longer. Instead of making your second cut at 3-1/4", it should be made at 4-1/4".
2. Using a hammer, beat the tab between the two slits down and out of the way. This is a good place to release any pent-up anger. The farther down you're able to get the tab, the better.
3. Once the tab is bent out of the way, finish the edges and points of the two cuts. The smoother the finished slot is, the better it looks and the less likely it is to draw blood.



Oil Return Line

Bags to use: #2A, #5A

Drilling and threading a hole in the oil sump is a perfectly safe process. Should any shavings slip through, they will find it very difficult to get off the bottom of the sump and into the oil pickup. For rubber drain lines, the drain hole location is 2” below the upper lip (no lower!) and as far forward on the left side of the sump as possible, directly under the A/C compressor bracket (if so equipped). See picture below. For the FM hard oil drain line (optional), the drain hole location will be determined by the location of the hard line after it and the turbo are mounted (but should be very similar). See the separate instructions for the hard lines. If you have compressed air that you can regulate, set the pressure to 5psi and connect a hose to the valve cover breather on the left side of valve cover. Drill until the bit just breaks through, then up pressure to 10psi. Keep the air blowing while you drill and tap the hole. DO NOT use pressure over 10psi at any time. More pressure will blow the seals out of the engine! Be sure to wear eye protection as the aluminum shavings will be blowing out of the oil pan.

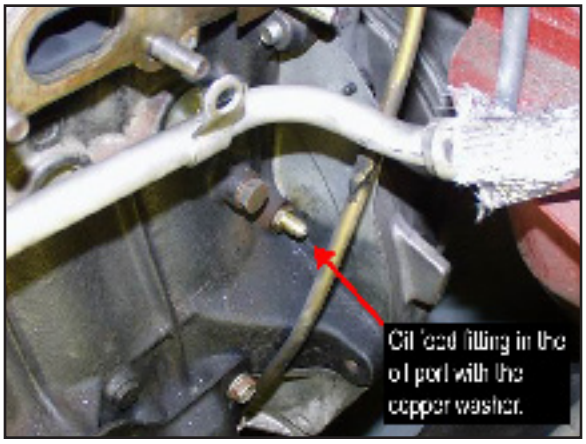


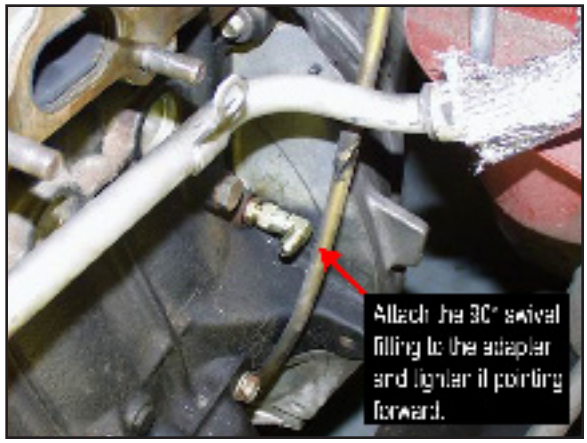
1. The hole needs to be drilled with the supplied .578” (37/64”) diameter bit. Use a center punch so your drill bit won’t walk and start with a smaller drill, then work up to the larger bit. STOP DRILLING AS SOON AS YOU BREAK THROUGH! It is possible to hit the oil pick-up tube if you continue through. This is “not a good thing”, as it will cause loss of oil pressure. A good way to stop the bit from going too far is to wrap the bit with a few layers of masking, electrical, or duct tape about 1/4” from its end. Try to get the drill as straight as possible, but it’s okay if it’s angled slightly. It’s very important for the tap to go in straight, however.
2. Keeping the compressed air running, tap the threads with the supplied 3/8" NPT tap. Measure the distance from the surface of the drilled hole to the closest edge of the pickup tube, then wrap tape around the tap at a distance a 1/4” less than what you measured from the end of the tap. This will ensure that the threads are completely cut, but the tap is still far enough away from the oil pickup. Grease the tap to help collect the shavings. Use a socket and extension to spin the tap. Again, make sure that the tap goes in straight. Do this by hand - spin it in by hand a couple turns, back it out one turn, and repeat.
3. Clean the surfaces as thoroughly as possible, using a thinner or something similar. Otherwise the adhesive used in the next step won’t stick.
4. Put JB Weld epoxy or silicone sealant on the threads of the 3/8NPT -> 5/8” hose barb (36-50020) and screw it in tightly. Grease the inside of the 5/8” hose (36-40231) and slide it onto the fitting. Route the hose upward so that it can be accessed from the engine compartment.
5. Remove the oil drain plug and place a clean catch pan under the oil sump. Attach a funnel to the top of the hose and pour the mineral spirits down through the hose to clean out shavings.
6. Allow the solvent to drain for approximately 15 minutes before replacing the sump plug. Remove the hose from the sump and set it aside for later use. If the hose is difficult to remove, cut it at the barb. The length of the hose is a few inches longer than necessary.

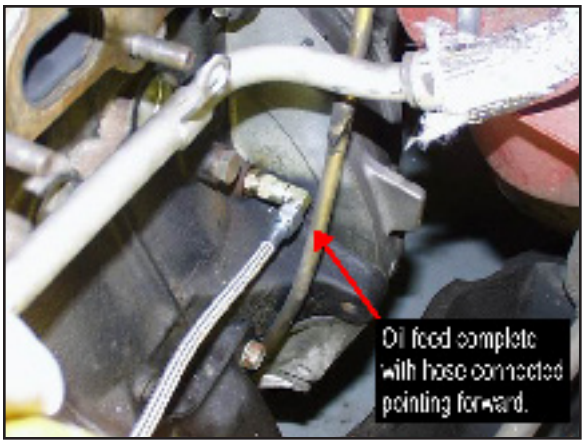
Oil Supply Line for '90 - '95 Cars
Bag to use: #4A

The oil supply system is the lifeblood of the turbo. When running the oil supply line make sure that there aren't any sharp bends, and it is clear of heat sources. The oil supply will tap into the oil galley on the left side of the engine block. Alternatively, if our oil filter relocation kit is installed on the car that can be used as an oil source (a longer hose will be required, contact us). Follow the directions included with the relocation kit. Regardless of what you use as a source, do NOT use Teflon tape on any of the oil lines (or fuel lines, for that matter). A small piece could get into the oil passages and clog them, which is definitely a bad thing.

1. There is an unused oil galley on the left side of the engine block down close to the bell housing. Remove the plug. This is a 14mm bolt head.
2. Install the oil line adapter fitting (27-12365) into the galley at the position shown. Use the crush washer.
3. Add a couple drops of oil onto the flare portion of the oil line adapter fitting. Install one of the 90-degree swivels (27-12467) onto the fitting by getting it finger tight then tighten another 1/4 turn ensuring the swivel is pointed forward. The flare can be damaged, don't overtighten it.
4. Add a couple drops of oil onto the flare portion of the swivel fitting. Attach the braided hose (27-32105) to the fitting and tighten. Cover the other end with a small plastic bag and let it hang loose for now.

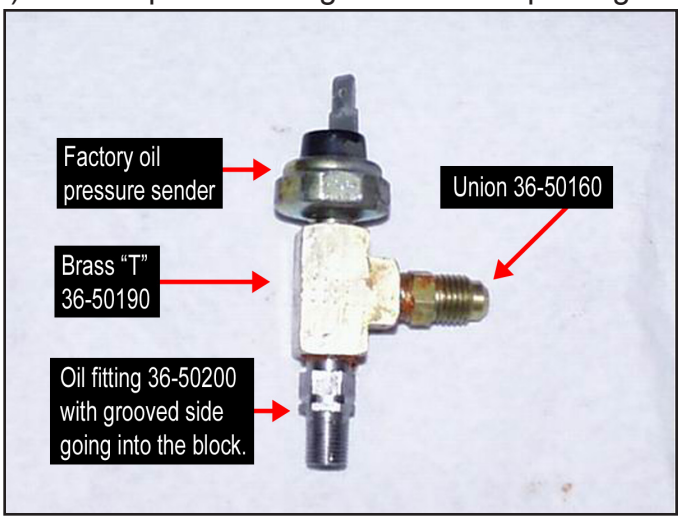




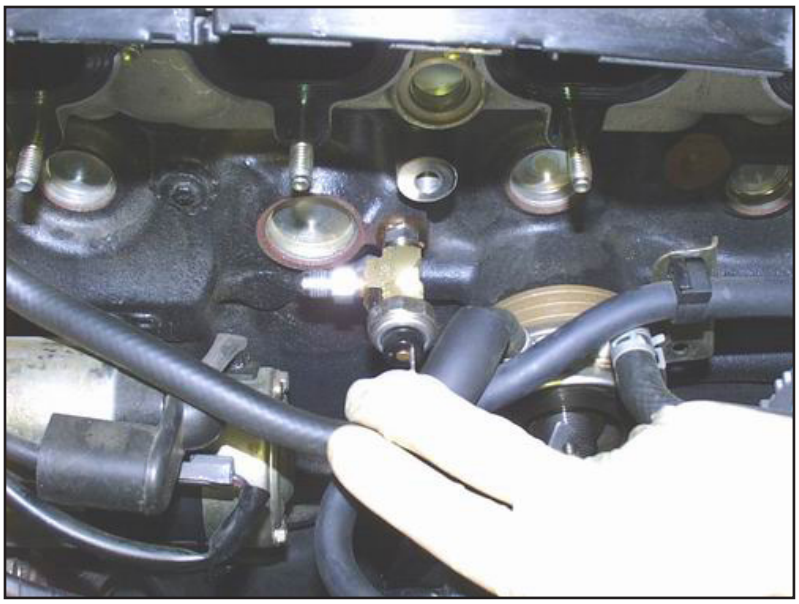


Oil Supply for '96 - '05 Cars
Bag to use: #4B

The oil supply system is the lifeblood of the turbo. When running the oil supply line make sure that there aren't any sharp bends, and it is clear of heat sources. The oil supply will tap into the oil galley at the oil pressure sensor located under the intake manifold between cylinders #2 & #3 above the oil filter. Alternatively, if our oil filter relocation kit is installed on the car, that can be used as an oil source. Our oil filter relocation system does make sourcing the oil quite a bit easier on a 96-05. Follow the directions included with the relocation kit. Regardless of what you use as a source, do NOT use Teflon tape on any of the oil lines (or fuel lines, for that matter). A small piece could get into the oil passages and clog them, which is definitely a bad thing.



1. Remove the oil pressure sensor using a 15/16" socket.
2. Put the 1/8 NPT tee in a vice and attach the oil fitting (36-50200). The side without the internal chamfer / bevel goes into the block, the side with the chamfer / bevel goes into the tee. (The slightly - ~.020" larger diameter side goes into the tee, if you need a double-check). Next, add the oil pressure sender as shown to the right. Do not use Teflon tape here (or anywhere) as a small piece of it could find its way into the oil system and plug up an oil passage. Instead, use a **small** amount of sealant on the threads (no sealant on the first couple of threads though). Do not add the union, 27-12255 (incorrectly labeled as 36-50160 in the picture), now as it will be installed after the assembly is in the block. Since these fittings have tapered threads, they don't have a specific torque value. Make sure they're snug, but you'll have to be the torque wrench here.
3. Thread this assembly into the engine block, again using sealant on the threads (as described above). Be sure to thread it into the hole shown in the picture. An easy way to be sure you have the right hole without being able to see it is to feel how close it is to the freeze plug. When tightening the assembly, make sure the port for the union faces aft. Once the assembly is tight, thread the adapter (27-12255) into the tee. The union needs a small amount of thread sealant on the union side, but not on the hose side.



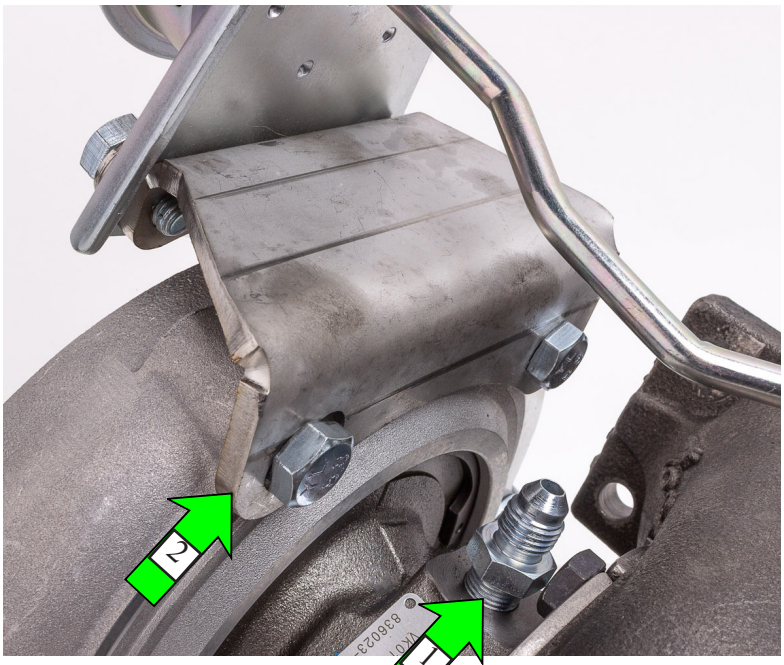
4. Put a couple drops of oil onto the flare of the union, then connect the oil supply line (27-32280) to the union and run it up to the top of the engine (again, NO sealant here). Tighten the line to the union by getting it finger tight then turning it another 1/4 turn. The flare can be damaged, don't overtighten. Cover the other end with a small bag for now. Note: The intake manifold has been removed for a clearer picture. It is not necessary to remove it for installation of the oil fitting.

Assemble Manifold, Turbo, and Outlet

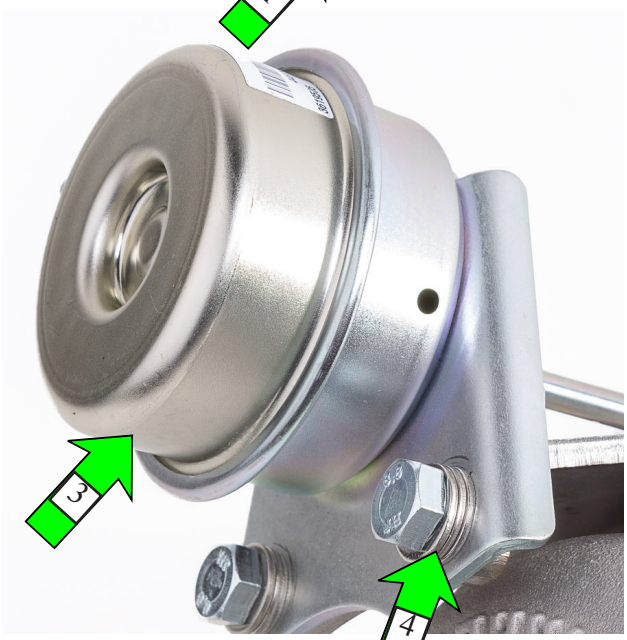
This only applies to those who haven't opted to have us assemble the manifold, turbo, and outlet. If those pieces are separate in your kit, follow these directions. If they're assembled, ignore this page.

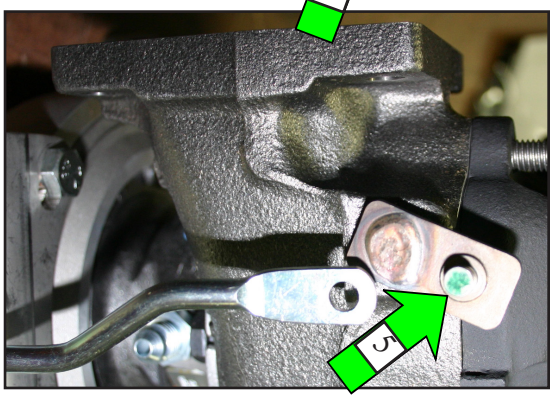
DON'T USE THE INCLUDED GASKETS

No gaskets are used between the manifold and turbo, turbo and outlet, or outlet and downpipe. If you use a gasket in any of these locations, it will just fail and you'll have to take everything apart to remove it. All of our pieces are machined flat (the downpipe actually has a slight dome to enhance the seal), so they will seal once tightened down.

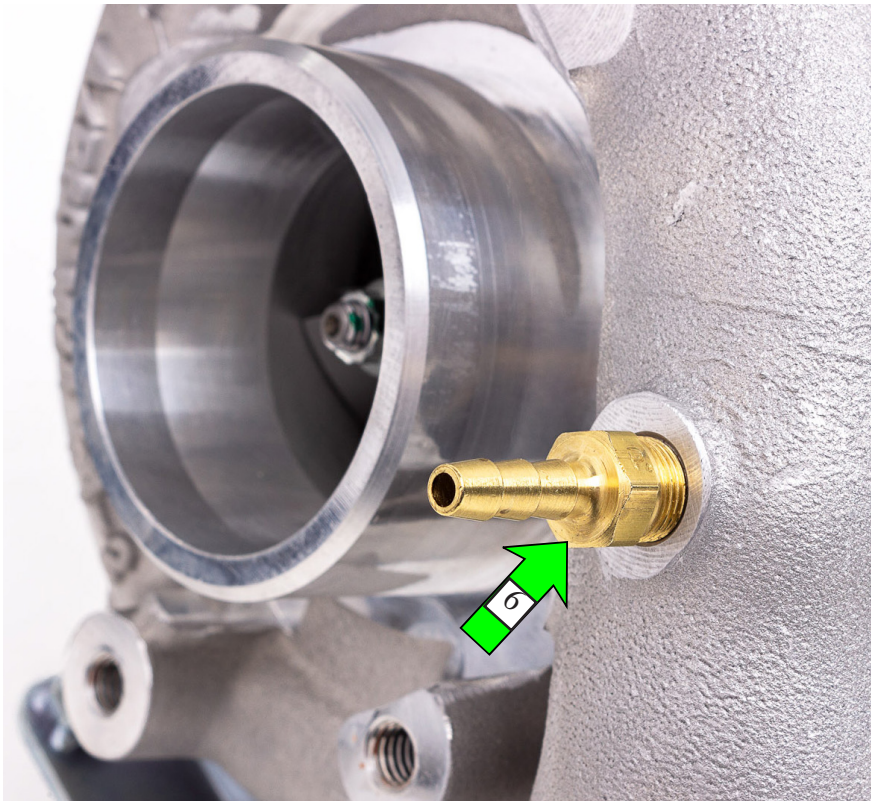


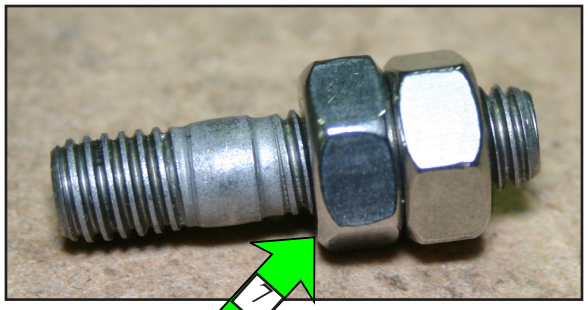
1. Put a drop or two of oil on the top of the turbo, then install the oil supply fitting (27-12211, arrow 1). Be sure the male tapered end points straight up. Tighten this to 11 lb-ft - in other words, get this snug but be careful to not overtighten.
2. Remove the two loose bolts in the front of the compressor housing that originally held the (uninstalled) wastegate actuator. These won't be reinstalled.
3. The wastegate actuator bracket will replace the top-most of the three two-bolt brackets / straps that hold the compressor housing to the center section of the turbo. Remove that bracket and install the included stainless steel bracket (22-60000, arrow 2) using the shorter bolts (36-10418) from the hardware kit (don't reuse the bolts that came out). Don't tighten the bolts down yet. Bolt the wastegate actuator (448734-5, arrow 3) to the stainless wastegate bracket using the longer bolts (36-10420). Each bolt should receive three washers (36-50130, arrow 4) between the bolt head and the actuator, as shown.
4. Remove the C-clip on the pin for the wastegate door itself (5) - be careful when you remove the C-clip, they seem to be allergic to humans and like to rocket away. Holding a magnet close is a good idea. Pull the wastegate actuator's arm out and over the pin for the wastegate door. You'll have to pull against the spring in the actuator, which is correct. You also may need to rotate the arm, which is okay within reason. Finally, carefully reinstall the C-clip.

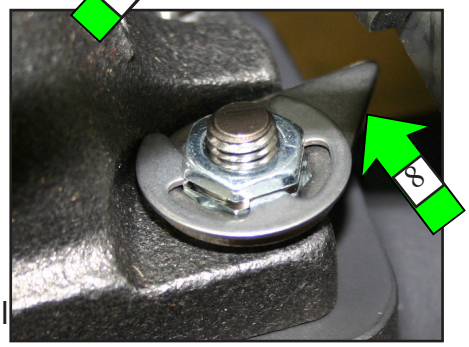




5. Check to be sure that the arm won't contact the inside of the hole in the actuator that it travels through, slide the wastegate bracket as necessary to be sure there's no interference. Once it's oriented properly, tighten the bolts holding the bracket to the compressor housing.
6. Install the hose barb in the front (6). Use thread sealant and get this snug but don't overtighten. This is another NPT thread, so it's tapered (it won't appear to bottom out on anything).
7. The banjo bolts will be used later with the water lines.
8. All of the non-Inconel hardware here should be torqued to 16 lb-ft / 190 inch-lbs. The Inconel studs should be torqued to 24 lb-ft / 290 in-lbs.
9. Install the included studs. Be sure that the non-Inconel studs (36-10331) are installed such that the nut will ultimately be installed on the long end. The Inconel studs (36-10339) are symmetrical, so that's a non-issue. The Inconel studs go into the manifold, the stainless studs are used for both sides of the outlet. Use two M8 x 1.25 non-locking nuts (36-20240), tightened against each other, as a surface for your wrench (7), so that you can tighten them down. Once the stud has been tightened down, loosen the top nut while holding the bottom nut, remove both nuts, then move on to the next stud. Install the studs in the manifold, turbo, and outlet.
10. Bolt the turbo onto the manifold. Don't expect to be able to get a torque wrench on all of the hardware, it won't be possible for most. Just make a close approximation of 16 or 24 lb-ft. Do get the hardware snug, but don't go crazy. With the Stage 8 hardware (36-00000), tighten the nut, then slip the tab onto the nut as shown (8). You want to position it such that if the nut tries to loosen, the tab will interfere with something - in the picture, you can see that the tab will interfere with the turbine housing if the nut loosens; be sure to do something similar on all of the nuts. Once the tab has been properly positioned, snap the E-ring into the groove for the nut.
11. Now slip the outlet over the studs on the turbo and bolt it down. Again, you probably won't be able to use a torque wrench.



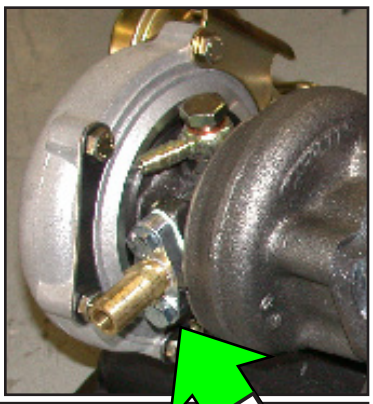




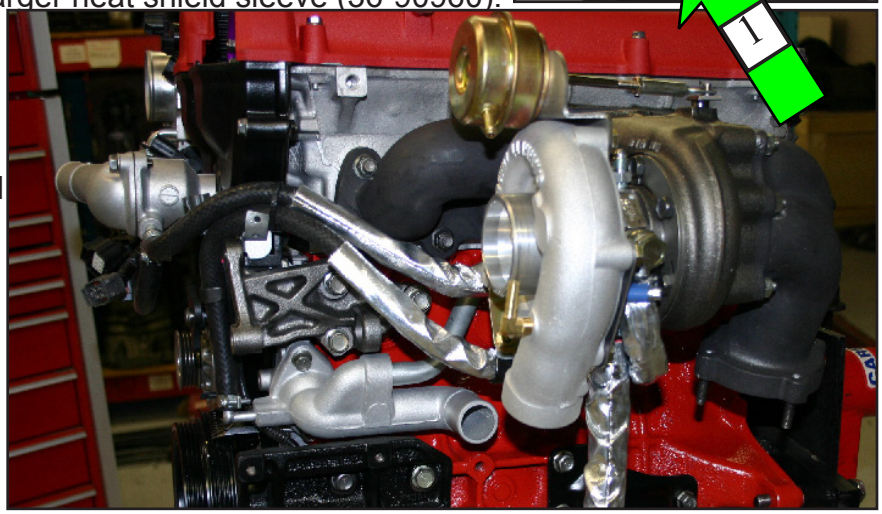
Mount Turbocharger Assembly

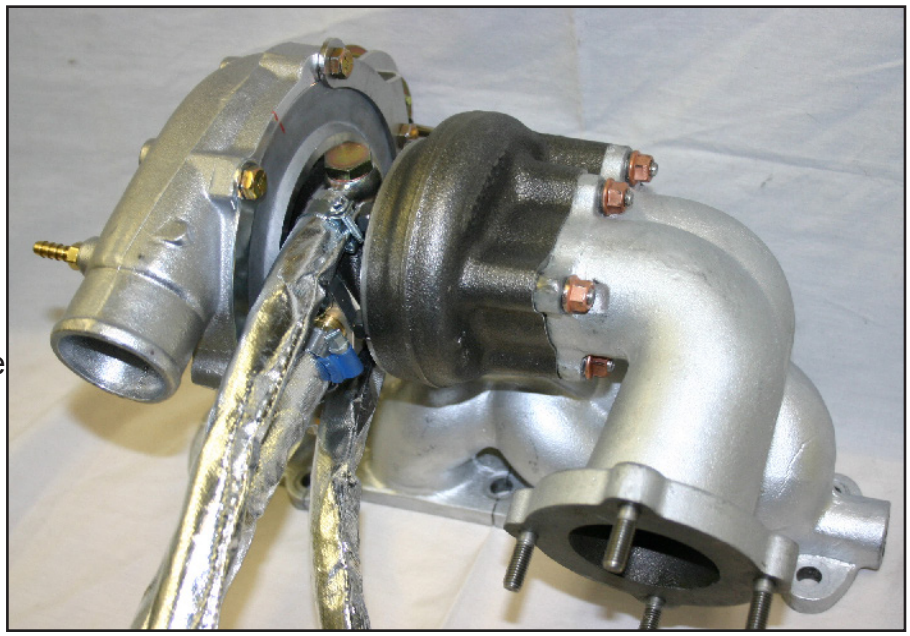
Bag to use: #3A, #5A

The turbocharger, exhaust manifold and turbine outlet casting should now be one piece (having been assembled by you or us). This complete assembly will be mounted onto the engine. The assembly will look like the photo below with the standard oil and water lines. **If you're using our hard lines, ignore steps 1 - 5 and follow the hard line instructions. Then come back to these instructions and start with step 6.**

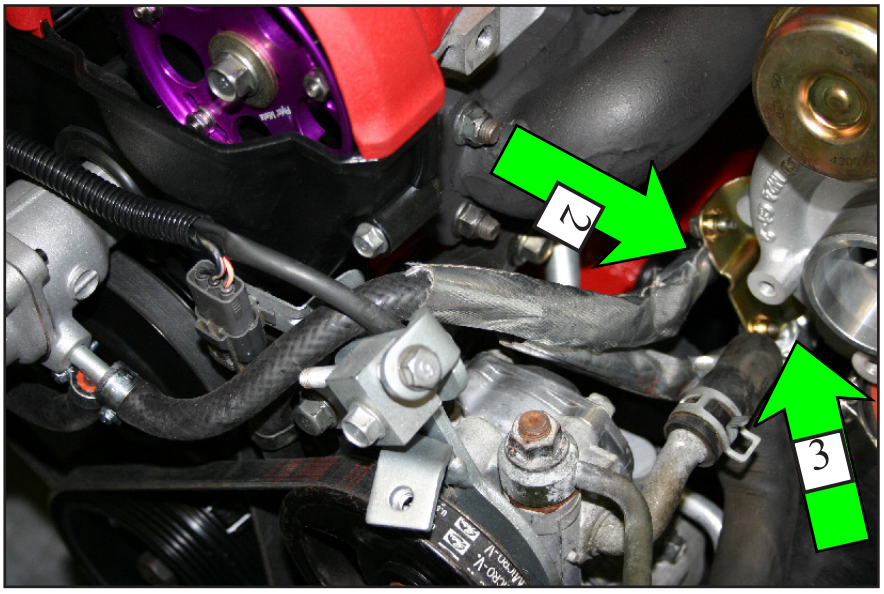


1. Bolt the aluminum adapter (02-70501) onto the bottom of the turbo with the gasket (02-70510) smeared with sealant in between it and the turbo (1). Then thread the hose barb (36-50020, with thread sealant on the threads) into the fitting and tighten it.
2. Lubricate the inside of the 5/8" oil drain line (36-40231) with grease/oil. Slide the oil drain hose onto the middle fitting on the bottom of the turbo. Cover the top of the hose with larger heat shield sleeve (36-90960). Secure the hose with the 14-27mm hose clamp (36-70005).
3. Add the water hoses (36-40120) to the turbo. The inboard (closer to the engine) hose should be 30" long and the outboard (closer to the fender) hose 36" long. We include one 66" length of hose, cut it accordingly. You'll need to push each hose onto the banjo fitting (02-70520, hose barb), then slip them onto the banjo bolt (02-70525). Be sure to place a crush washer (04-38015) on either side of the banjo fitting while installing them onto the turbo. Try to orient the hoses so that their natural curve points them towards the front of the engine. Slip the heat shield up as far as possible, and secure the hose and heat shield with the 3/8" hose clamps (36-70202). The outside banjo fitting should be left loose, it will be removed after the next step.
4. Using the supplied 3/4" loom clamps (36-70500), secure the water lines to the gold or silver bracket attached to the compressor housing on the turbo. Be sure that the loom clamps are oriented so that the bolt is above the water line, as in the picture. Again, the loom clamps need to go around the hose and heat shield. Be sure that the lines don't have any kinks in them, aren't too tight, and aren't too close to the exhaust manifold. The inboard line will go to the upper mounting point (2), the outboard line will go to the lower mounting point (3). The picture shows the turbo



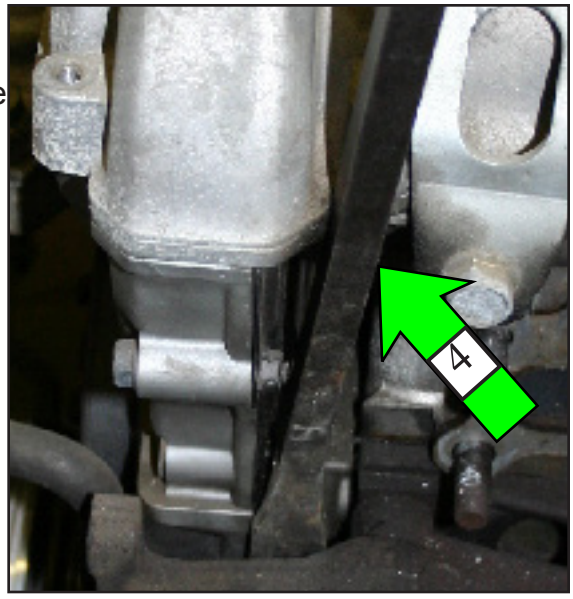


assembly already mounted on the engine, however, the bracket for the water lines is easier to access before the assembly is mounted. Once both water lines have been secured to the bracket, the outboard line will need to be pulled off of the turbo. Leave the line on the banjo fitting, and remove the banjo fitting from the turbo - don't lose the washers! While slipping the turbo assembly into position, be sure that this water line is still accessible.

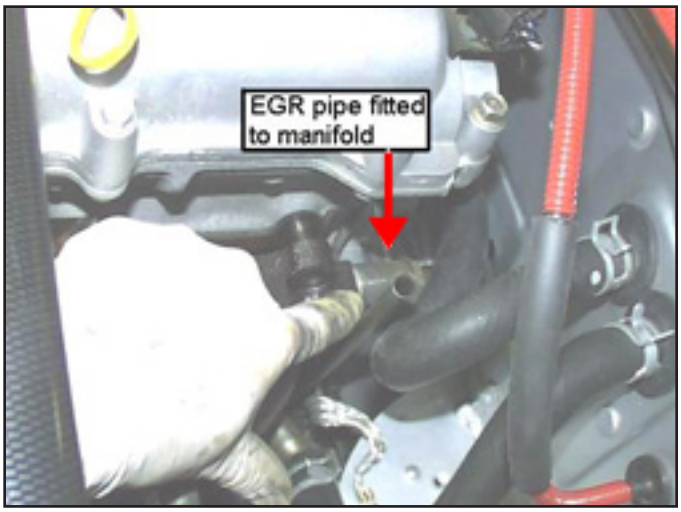


5. Remove the rags from the exhaust ports.
6. Be sure that the tab on the heater bypass tube (the metal tube running underneath the exhaust ports) is not on the exhaust stud. The proper order here is head-manifold-tab-nut, although it's easy to get the tab between the manifold and head (head-tab-manifold-nut). This makes the exhaust very loud, so if your car is louder than it should be - and the noise is coming from the exhaust manifold - check the tab.
7. Install the exhaust manifold, turbo, and outlet casting assembly onto the engine. Use the new gasket (06-90300) between head and manifold. **NOTE:** If the assembly won't fit between the head and the frame slot that you cut, you have two options:
    1. First, you could rock the motor up, towards the passenger side. This is the easiest method - if you have a pry bar and an extra person, we suggest you try this method first. The easiest way to do this is to put a large pry bar between the power steering pump and the head/valve cover (4, next page). You'll need a helper to pull the motor over as you're installing the turbo assembly. Be certain that you're not prying against anything breakable.
    2. The second option is to lift the motor up. You'll need to place a jack under the oil pan, to hold the motor up. Be sure to use something (e.g., a piece of wood) to distribute the load. Then loosen the nut holding the driver's side motor mount. This is accessed from the outside of the subframe, behind the left front wheel. It's recessed in a large hole. Once the nut has been removed, jack the motor up, but only enough to slip the turbo assembly onto the studs. Once it's on the head, lower the motor back down (be sure the stud slips back into place, and replace the nut. This nut should be re-torqued to 42 - 57 lb-ft.
8. As the manifold is being placed into position, route the oil drain hose behind the AC compressor, then forward. The water lines should be routed above the new radiator hose, they will be located later. Once the manifold is on the studs, attach the water bypass tube bracket to the exhaust stud, as it was originally configured (refer to step 7 in this section). Re-attach the outboard water line. If the turbo isn't fitting perfectly with the hoses and such, you could rotate the compressor housing. Loosen the six bolts that hold the compressor housing to the center section. Gently rotate the housing as needed, being sure to keep the housing parallel to the center section. It shouldn't need

to be rotated much. Bear in mind that it's relatively easy to damage the impeller wheel if the housing isn't square, and a damaged impeller requires a turbo rebuild. Once the compressor housing is properly oriented, check the rod that comes out of the wastegate actuator. Be sure that the rod won't contact the edges of the piece that it comes out of. Pull the rod out by hand to be sure that there's no contact anywhere in its travel. If it does make contact, re-orient the actuator bracket until the it clears. Finally, tighten the six screws. Get the bolts snug but don't go crazy, you are tightening into aluminum.



9. Secure the exhaust manifold with the factory nuts. Start with the center nut and move out to the ends in an alternating sequence. Torque to 29-33 lb-ft.
10. **'94 - '05 Cars only:** Attach the EGR tube (94-97: 22-60200, 99-00: stock, 01-05: 06-96000) to the fitting on the #4 runner on the exhaust manifold. Unbolt the bracket holding the EGR tube at the rear of the head to allow more movement of the tube. The bracket at the back of the head is not a very critical one, but it is very difficult to access. This bracket can be left off if desired. **'99 - '00** cars will reuse the stock EGR tube, the remaining cars will have a new EGR tube included in the kit. **'90 - '93** cars do not have an EGR tube. If a new EGR tube is used, there's an easier way to install it. Once the EGR tube is behind the head, slip the flange over the studs on the intake manifold. Then start to thread the fitting into the exhaust manifold. Be sure that the threads are not going in sideways, as it might be difficult to thread in properly. Once the threads are started, be sure that the flange



on the intake manifold will sit flat. If not, carefully "tweak" the tube as needed. Once everything is properly oriented, install the nuts on the studs holding the flange to the intake manifold. Once all of the threads have been started, tighten everything down. Be sure to re-attach any grounding straps that may have been removed. Also be sure that the heater hoses don't touch the EGR pipe; shorten them if need be. Be very careful removing the heater hoses - the metal pipes that they're attached to are very fragile, we typically cut the hose off instead of trying to pull it off. If you only cut the portion on the pipe, you'll be able to shorten the hose and reinstall.

11. Connect the downpipe (22-46XXX) to the turbine outlet casting and the catalytic converter. Be sure to apply high-temp anti-seize to the studs first. There is no gasket used between the cast outlet and the stainless steel downpipe. There are slots at the top of the downpipe to allow rotation to help everything align properly. Use the M8x1.25 lock nuts (36-20120) and lock washers (36-

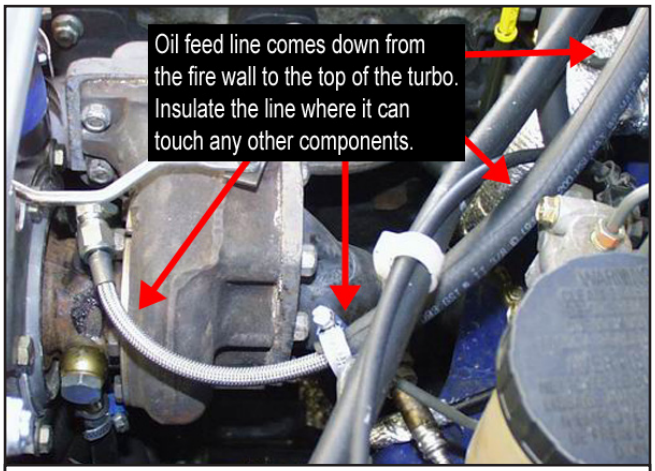
30300) here. These nuts can be pretty challenging to access. There is a relatively large open area between the frame and subframe, which is a good way to get to those nuts. The left front wheel can be removed if you really want easy access. However, accessing them from below is by far the easiest if you have the proper tools. A swivel joint and long (18”+) extension for your wrench is necessary to access the nuts from below, it’d be worth the money to get them. Once this is done, slip the bottom end of the downpipe on, using the clamp. NA cars should use the included gasket when connecting to the catalytic converter, NB cars retaining the stock post-downpipe exhaust should use the stock gasket but NOT the included gasket. NB cars using our exhaust should use the included gasket. If the exhaust system is on the car, tighten all of the connections, including the clamp. Do this sequentially, being sure that nothing is pulled into an unnatural position. Otherwise, leave the clamp and lock nuts loose and tighten it and the downpipe-to-turbine outlet nuts once the downpipe has been lined up with the rest of the exhaust. Do not tighten anything until the entire exhaust system has been connected and oriented properly. If the end of the downpipe is too low or high, try rotating the turbo at the manifold. If you loosen the nuts, there should be enough tolerance between the studs and the holes on the turbo to allow some rotation. You might be able to rotate the turbo without loosening all four studs, so try just loosening two or three at first. The fourth nut is very challenging to get to. A small difference in the orientation at the turbo can equate to a relatively large difference at the end of the downpipe, so it’s a good place to start if things aren’t fitting exactly right.

12. Install the factory O2 sensor in the open hole closest to the outlet casting. Be sure to use anti-seize on the threads. Disconnect the factory narrowband O2 sensor wire from its anchor at the bell housing spacer plate, if necessary. Be sure that the wires are clear of any heat sources. The second hole, closest to the catalytic converter will be used for the wideband O2 sensor. If you don’t have a wideband to install, be sure to install the provided plug. If you don’t, you’ll have a pretty obvious (and noisy) exhaust leak.

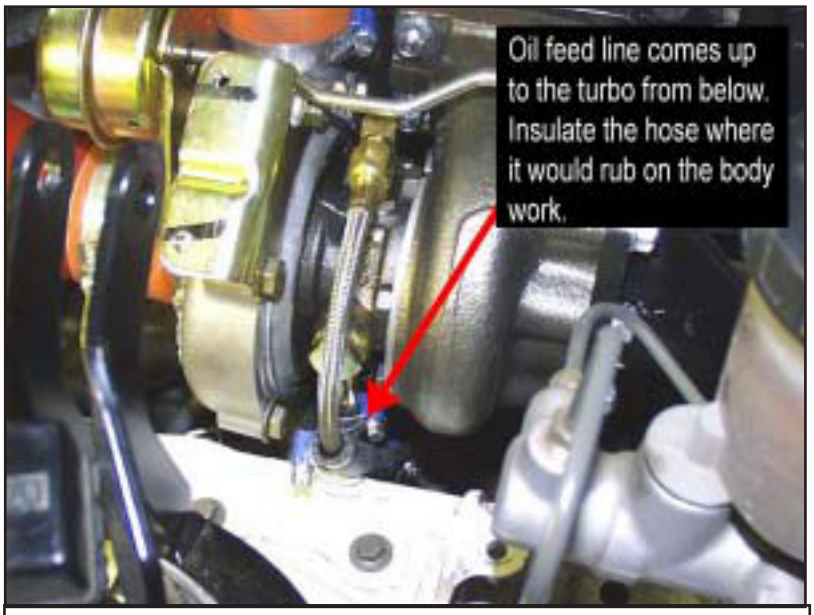
Oil Lines

Bags to use: #4A/#4B, #5A

1. For the standard rubber line, route the drain hose down, outboard of the steering shaft, and onto the fitting at the sump. Secure with a 14-27mm clamp (36-70005). Again, this is a tight fit, so cursing may be helpful. A A little grease inside the hose will make it go easier. **Ensure that the drain hose always travels downhill, to prevent pooling,** and does not interfere with the steering shaft. The hose will need to be trimmed for a perfect fit. For the optional FM hard drain line, see the separate instruction sheet for details.
2. **'90 - '95 Cars Only:** Route the oil supply line (27-32105) up from below the turbo and attach it to the swivel fitting on top of the turbo. Add the 3" piece of hose (36-40220) around the oil line where it could otherwise rub on the inner edge of the bodywork. Retain with a single 8-14mm hose clamp (36-70202). Put a couple of drops of oil on the flare (27-12467), then tighten the oil line onto the swivel fitting by getting it finger tight then turning it another 1/4 turn. The flare can be damaged, don't overtighten it.
3. **'96 - '05 Cars Only:** Route the oil supply line (27-32280) across the rear of the engine on the firewall and around the rear of the turbo. Attach it to the swivel fitting (27-12467) on the turbo. Put a couple of drops of oil on the flare, then tighten the oil line onto the swivel fitting by getting it finger tight then turning it another 1/4 turn. The flare can be damaged, don't overtighten it. Add the 18" piece of rubber hose (36-40220) around the line where it would otherwise contact the brake master cylinder and brake lines You'll need to slit the hose to fit it around the braided line. Retain with a single 3/8 hose clamp (36-70202).



'96 - '05 and MSM



'90 - '95

4. Tie wrap the oil line in a few places to secure it. Use additional tie wraps to keep the oil line from contacting the turbine housing and any other damaging heat sources.

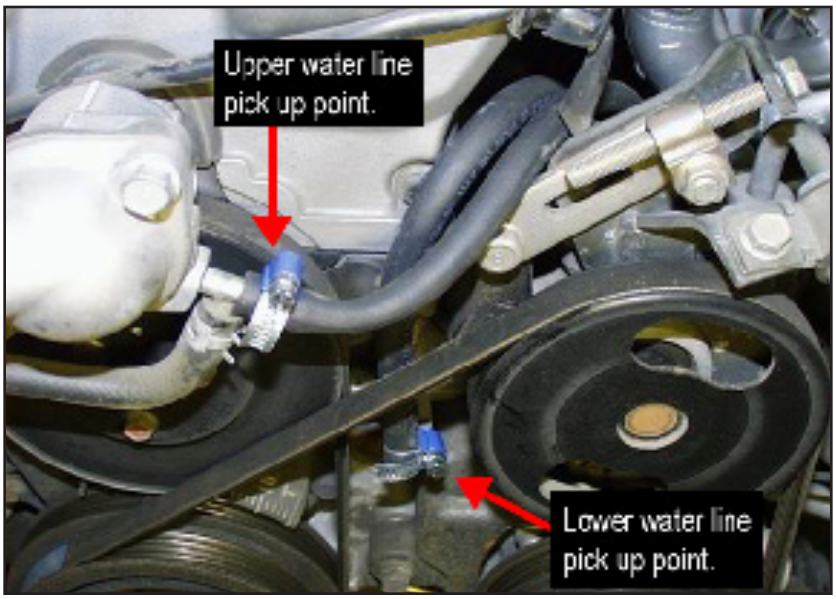
Caution: The stainless steel braid will chafe completely through brake lines, hoses, and body metal. Ensure that the line is not allowed to rub on anything that would not tolerate damage.

Water Lines

Bag to use: #3A, #7A/#7B

The Garrett turbo is water cooled and oil cooled. This is the reason it will live well past 100,000 miles with modest care. The water for the turbo will be picked up at the front of the engine. The specific routing we suggest is just that - a suggestion. As long as water goes into and out of the turbo, without the lines rubbing on anything or being too close to a heat source, the goal is accomplished. There is not a specific in and out on the turbo. For the standard silicone hoses, see the instructions below. For the optional hard lines, see their separate instruction sheet.

1. Under the thermostat housing, remove the small water hose that connects the thermostat housing to the small connection about six inches below.
2. Connect the outboard fitting to the turbo. Tighten it with the banjo fitting pointing straight down.
3. Route the inboard turbo water line to the upper hose fitting on the thermostat housing. The water line will need to go above the new coolant hose and over the power steering pump mounting bracket. Secure with a 3/8” clamp (36-70202).
4. Route the outboard turbo water line to the lower water hose connection. Again, the water line will need to go above the new coolant hose and over the power steering pump mounting bracket. Secure with a 3/8” clamp (36-70202). **Be sure both lines are far enough away from the belts.**
5. **'90- '95 Cars Only:** Tie wrap the oil feed line to the outer water line right at the turbo, to keep the oil line away from the inner fender. Make sure there is a piece of rubber hose over the stainless line to protect the water hose.

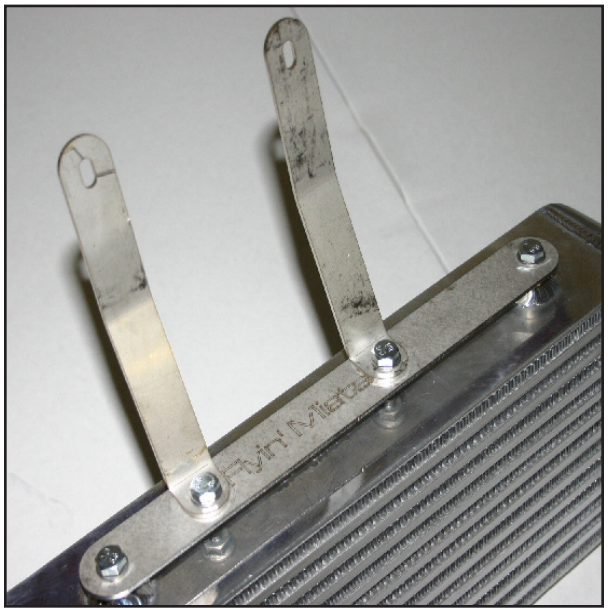


Mount Intercooler

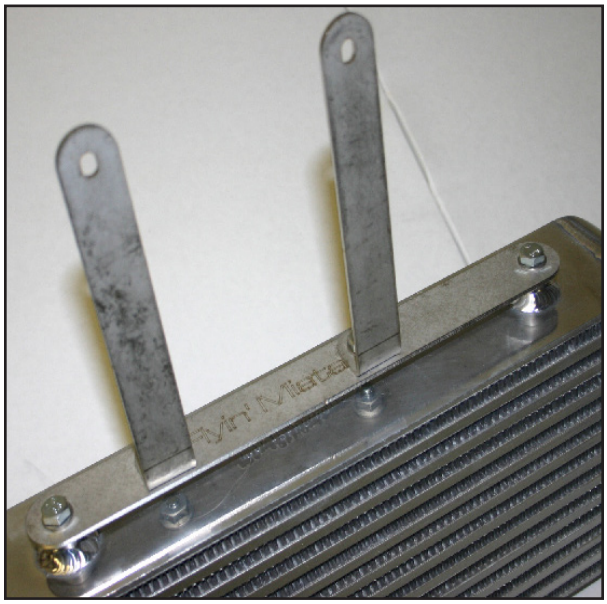
Bags to use: #6A

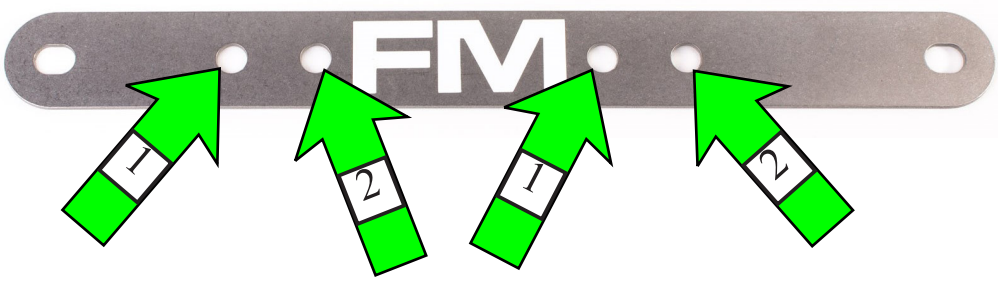
1. **Optional:** If you need to install an intake air temperature (IAT) sensor post-intercooler, we recommend drilling and tapping the passenger side intercooler end tank for the specific sensor size you need. Use thread paste to ensure a leak-free fit. Ensure the sensor will clear other parts, such as AC lines and undertrays before drilling. It is typically best not to install a post turbo IAT sensor into the intake manifold due to heat soak issues.
2. The inside of the intercooler needs to be cleaned out. Seal off one end of the intercooler and pour some mineral spirits into it. Seal off the second end and shake the intercooler, trying to get the mineral spirits all over the inside. Once satisfied, pour the mineral spirits out and dry out the inside with compressed air. If there isn't any compressed air available, let it air dry.
3. Mount the flat bracket with "FM" logo on it (22-31001) to the intercooler using the shorter bolts (36-10420). The bracket needs to be mounted so that the name can be read from the front of the car. There isn't a specific front or back to the intercooler; mount the bracket based on whether or not you want the FM logo to be displayed. The two outside holes are slotted to allow the location of the intercooler to be moved somewhat. Use a washer (36-30130) under each nut (36-20120) and bolt (36-10421).
4. Mount the remaining two brackets (22-31000) as shown, according to the year of your car. The holes indicated by arrow #1 are for '90-'00 cars with air conditioning (the intercooler must be offset to clear the AC drier), the #2 holes will center the intercooler. The intercooler can only be centered on '01-'05 (with or without AC) and non-AC '90-'00 cars.

'90 - '97

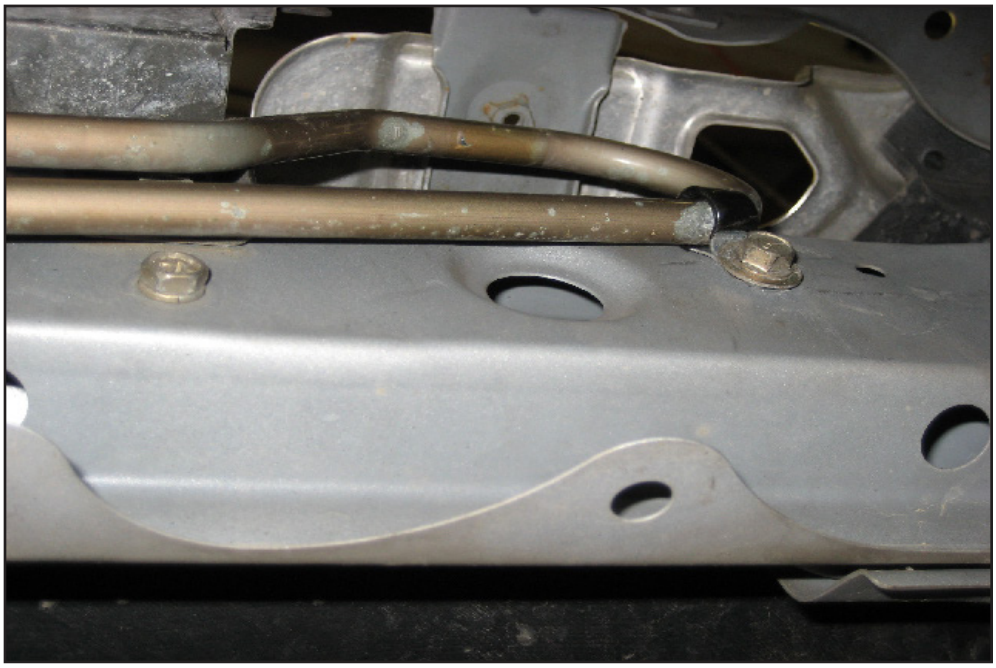


'99 - '05





5. **‘99 - ‘05 Cars Only:** If so equipped, the power steering cooler (the metal line attached to the front bumper support) might need to be relocated slightly. It’s a good idea to test fit the intercooler first. At the right most end of the cooler, near the 180° bend, remove the mounting bracket. The factory bracket can be used, but it should be re-oriented so that it points up instead of down. If it’s difficult to get apart, try wedging it apart by twisting a flat head screwdriver between the two tabs. The wider the blade, the better. Be careful to not stab the cooler, and be sure that the cooler does not get kinked.
6. Check the location of your horn. If it will interfere with the intercooler, either bend the bracket and/or relocate it (there should be a location nearby).



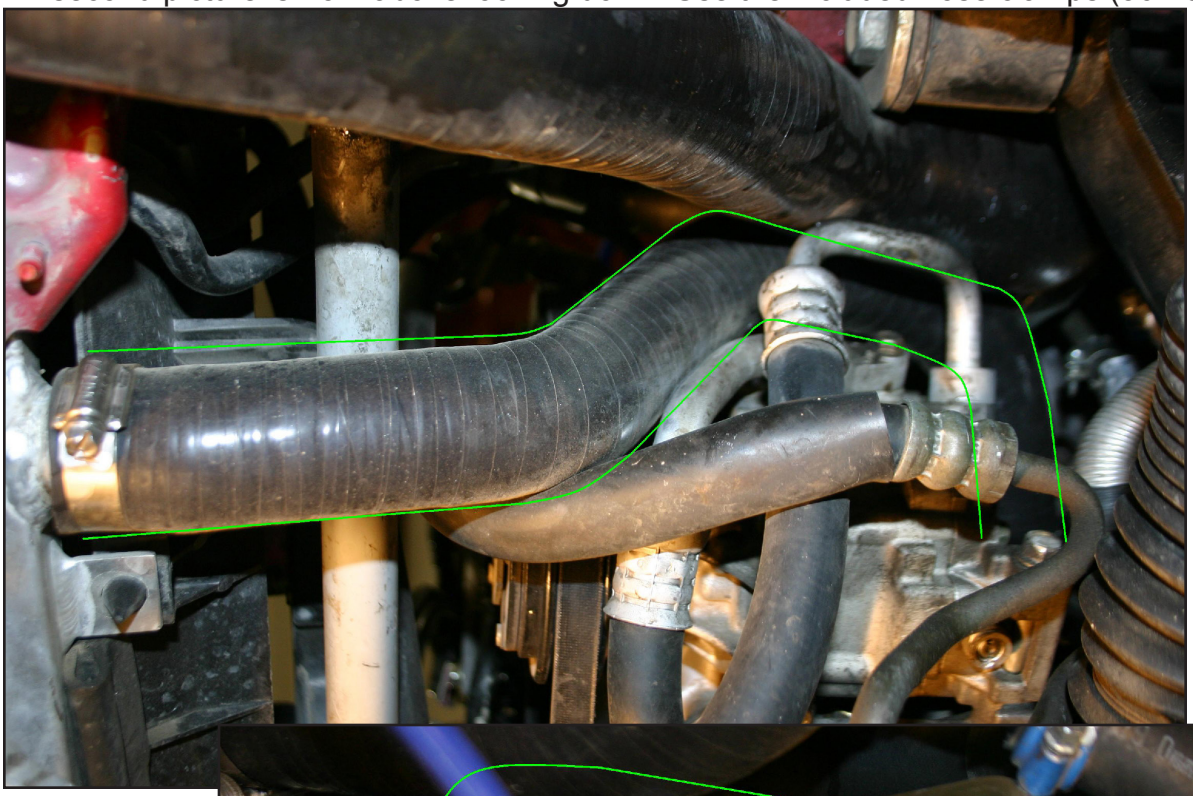
7. Remove the two bolts that hold the hood latch. Check the bolts (including the back side) for rust, as they can look fine from the front but be rusted in the back, resulting in broken bolts. If you find rust, spray a penetrant onto the rust and let it sit. The intercooler mounting brackets will slide between the hood latch and core support. The AC lines at the bottom of the condenser may need to be bent out of the way. If these do need to be bent, do so carefully. Re-use the hood latch bolts, and bolt the assembly back onto the core support. The bottom of the intercooler will be located by the intake hoses.

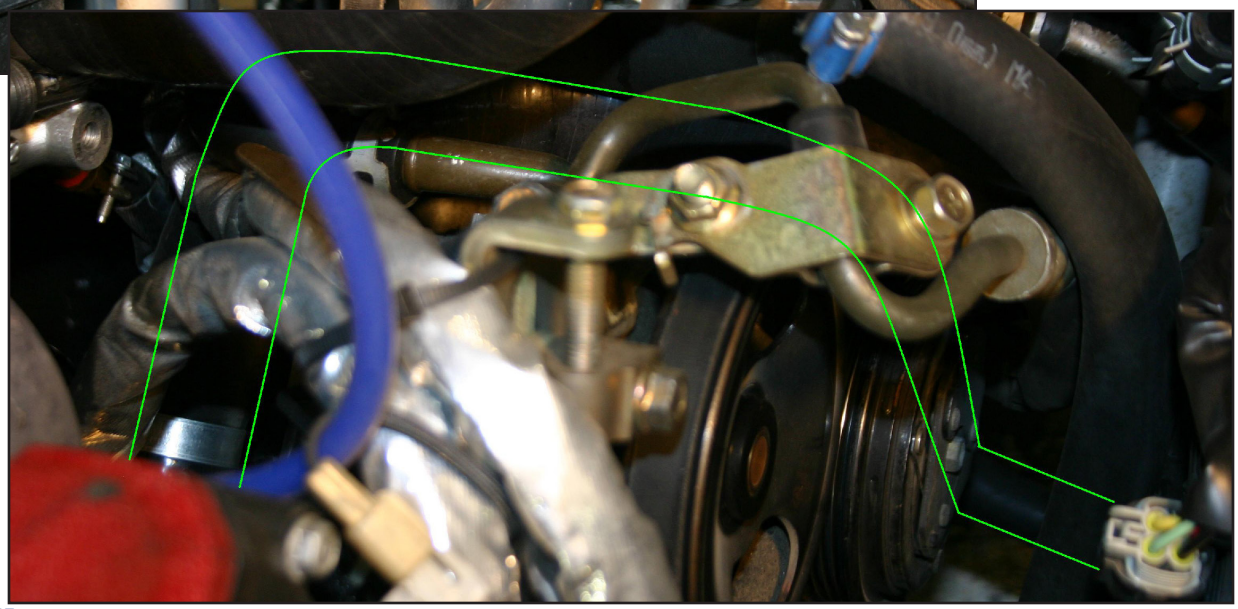
8. Be aware that if you opted for the larger intercooler, may need to move power steering lines and / or AC lines to create clearance.

Re-routing coolant

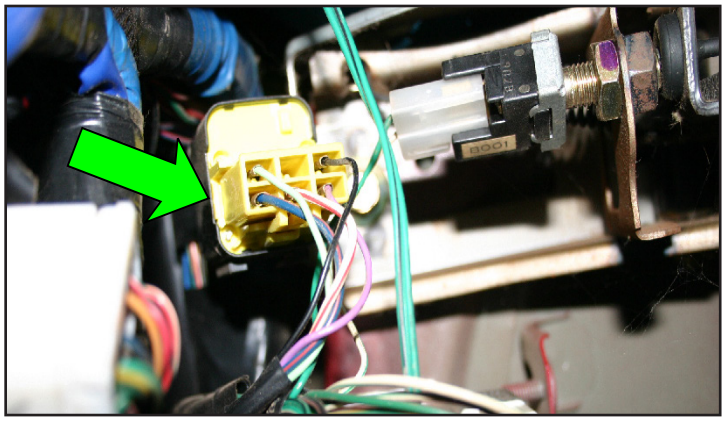
Because of the orientation of the compressor outlet, the lower coolant outlet plumbing needs to be changed. This step should be done in conjunction with Step 1 of Section 12, as the radiator hose and compressor outlet hose sit very close to each other.

1. Using the supplied radiator hose, route it from the radiator outlet to the inlet on the block. Follow the (rough) green outline to find the proper routing. On some cars and setups, the hose fits better if it goes underneath the AC lines - not above, as they do in the pictures below. It should be obvious which routing is best for you. If the radiator hose hits the compressor outlet hose, trim the radiator hose where it connects to the block. Be sure that you don't trim too much, but you'll almost definitely need to trim some. Use a piece of tape as a guide to ensure a straight cut. In a perfect world the hose wouldn't rub on anything, but chances are that there will be some contact. Try to minimize it, and be sure nothing with a sharp edge is rubbing on the hose. In those situations a piece of slit hose should be used as a buffer. The first picture is from the bottom looking up, the second picture is from above looking down. Use the included hose clamps (36-70030).



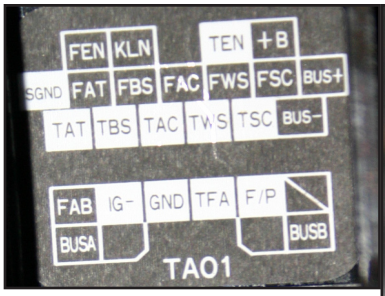


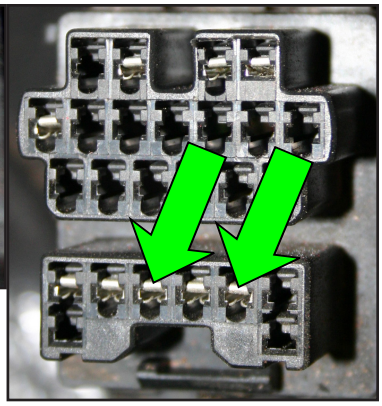
Install Fuel Injectors (optional)



1. The fuel system first needs to have its pressure relieved. First, find the relay that's pictured to the side. It will be underneath the dash, near the steering column. It should look similar to the relay in the picture, but different years had different relays, so it might not be exactly the same. Look for a blue wire with a red stripe on a '90 - '97 car, or a red wire with a blue stripe on a '99 - '05; that's the wire that goes to the fuel pump. Start the car and let it idle. While the car is idling, unplug the relay. This will kill the engine, as it's no longer being fed the fuel it needs. Turn the car off once the engine has stopped. The gas cap also needs to be removed, to ensure that pressure doesn't build up in the tank. Don't reinstall it until the fuel rail is fully installed.
2. **'99 - '05 cars only:** The upper intake manifold needs to be removed. There are eight ('99 - '00) or seven ('01 - '05) bolts that need to be removed to allow the two pieces to separate. Two of these bolts are below the throttle body. Be sure to remove any of the hoses and such that will prevent the top half from being lifted off. Make a note of where all of the lines go, so you're sure to put them back in the right places. Once these have been removed, tilt the top half forward and out of the way. Be careful of the various lines going to the throttle body. While they can remain attached, you need to make sure that they don't get kinked. Also put rags in the open holes, to ensure that nothing accidentally falls down there.
3. Remove the bolts that hold the fuel rail in. There are small black plastic spacers that these bolts go through, they're below the fuel rail. These are very easy to lose and very hard to find once lost, so be careful with them. Gently pull the rail off of the fuel injectors. There are also four small black rubber rings that the bottom of the injectors sit in, be careful not to lose these either. Set the rail out of the way.
4. Install the new fuel injectors. Be sure to lube the O-rings at the top of the injector with motor oil. Try not to get any of the oil into the bore of the injector. Also be sure that each injector still has its (new and included) rubber insulator on the base, and that the old insulators in the head / manifold have been removed. These insulators look somewhat like a thick, square O-ring. Slip the rail onto the injectors. Be careful here, this can be challenging. Be sure that each of the injectors is properly seated into both the head / manifold and rail. Also be sure that none of the O-rings get moved or pinched. Re-use the black plastic spacers at the bolts, again being sure to not lose them. Once everything is properly lined up, tighten down the bolts holding the fuel rail down. You should be able to turn the injectors, although there will be a little resistance. If they spin freely or won't spin at all, something's wrong. Take the assembly apart and see what has happened. If one or more of the injectors won't spin, chances are one of the O-rings was unseated and is binding. Fix this (replace the O-rings if they're damaged) and reinstall everything.
5. **'99 - '05 cars only:** Reinstall the top half of the intake manifold.
6. You'll need to verify that your installation is leak-free, but that shouldn't happen until the ECU has been installed. The steps to check for leaks is later in these instructions. If the ECU is in now, you can check for leaks now following those steps.
7. Tighten down the gas cap, reconnect the relay, and turn the car on - but DO NOT start it. Jump - a paperclip works well - "Gnd" and "F/P" in the Diagnosis box in order to keep the fuel pump on. This ensures that the system is fully primed. Leave the jumper connected for 5 - 10 seconds, then remove it. Once the fuel system is primed, check all of your connections and be sure that there are absolutely no leaks. Check all of the junctions where the fuel injectors seat into the fuel rail.

8. **‘90 - ’97 Cars Only:** Once certain that there are no leaks, pinch off the rubber return line - the line coming off the FPR (bolted to the fuel rail), going to the forward of the two hard lines at the frame - and check again for fuel leaks. Be sure that whatever you’re using to pinch the line won’t damage it. This increases the fuel pressure to the maximum, so you’ll be able to check for leaks in the situation most likely to create leaks. ‘99 - ‘05 cars run at a constant fuel pressure and don’t have a return line. Once you’re satisfied that there are no leaks, remove whatever you were using to pinch off the return line. Do NOT leave the return line pinched while the car is running.





9. It’s also a good idea to check for vacuum leaks where the injector seats into the manifold/head. To do this, spray carb cleaner at the seat of the injector - while the car is idling - and listen very closely to the idle of the car. If it stumbles, even a little bit, it means that the engine has sucked in carb cleaner, which therefore means that there’s a vacuum leak. Be sure that you can repeat this behavior before deciding that you have a vacuum leak. Chances are that the cause of this is that your injector seats are dried out and hard. You can get new ones from Mazda, or you can get two Ford fuel injector O-rings per one Mazda injector - the Ford O-rings should be stacked to equal the Mazda injector seat. These can be picked up at an auto parts store. Bring the original injector seat with you, so that you can compare sizes.

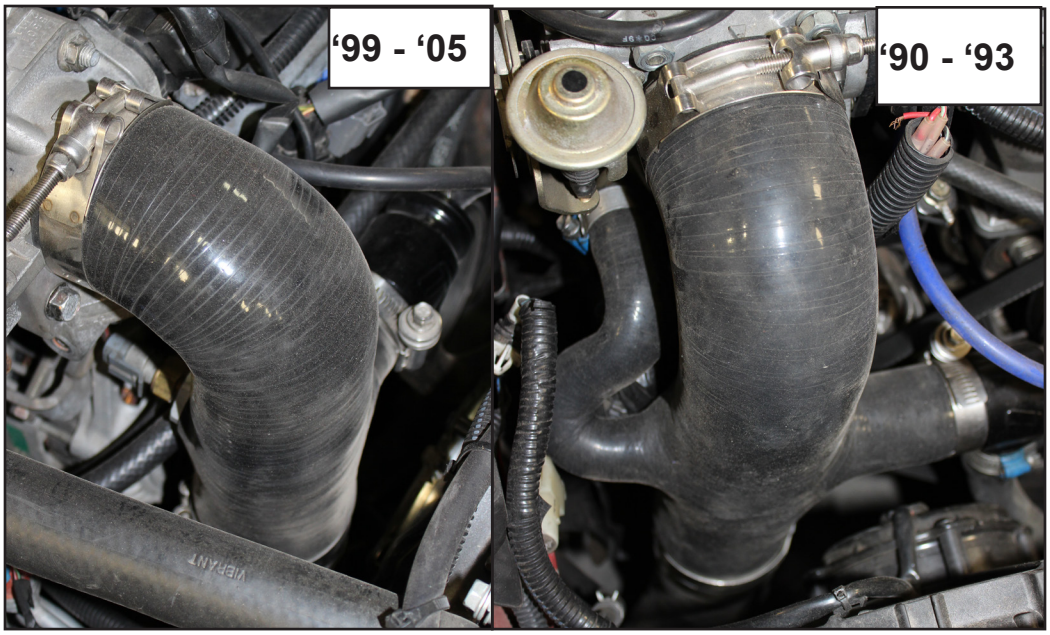
Intercooler Tubes
Bags to use: #6A

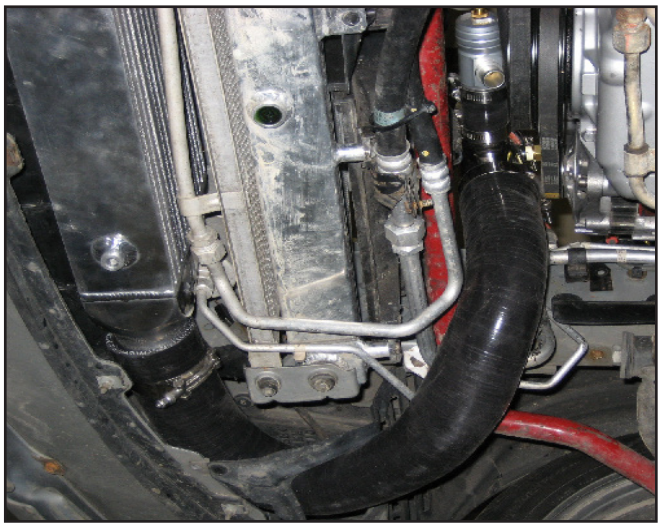
The silicone hoses used in the kit greatly simplify installation. As they are flexible, they can be bent around things while installing them. However, once they are installed, they should not have to be bent. Also, make sure that the hoses do not contact anything abrasive, particularly anything with a sharp edge. When securing the clamps, be sure to get the clamp behind the bead that is formed into the pipe.

1. Weave the compressor outlet hose (22-50100) up from below the car to meet the outlet on the turbo. The 2" I.D. end will connect to the turbo, the 2.5" I.D. end connects to the intercooler. If the rear power steering line coming off of the pump is in the way, it can be rolled up and out of the way (spin it counter-clockwise, when viewed from the front of the car looking back). Use the appropriate T-bolt clamps, 2.25" at the turbo (36-70303 / 238) and 2.75" (36-70308 / 288) at the intercooler, to attach the hose. Don't tighten the clamps until both ends are properly located. It's typically a good idea to get the compressor side all the way on first, as it's more difficult than the intercooler side to fit. If it's difficult to get the hose onto the compressor, try spraying some alcohol-based hairspray on the inside of the hose or the outside of the compressor outlet. This will provide lubrication to get the hose on, but will dry sticky to help the hose stay on. If you don't have hairspray, rubbing alcohol should work well. The main goal is to get something that will dry completely (soapy water will stay wet). This can be especially helpful with the small turbo (2554), as the adapter makes it more awkward to get the hose on. Be certain that the hose clamp is completely on the compressor outlet. If it's not, the hose will pull off of the turbo.

2. Weave the intercooler outlet hose (22-50200) up so that it sits just below the throttle body. The end of the hose with the sharper bend will connect to the intercooler. Attach the intercooler end of this hose to the intercooler using one of the 2.75" T-bolt clamps (288), but leave it loose for now. This will allow the hose to be rotated to better line everything up. Let the other end hang loose for now.

3. Install the throttle body inlet elbow (22-50310). Position everything appropriately. Note that on some older kits the throttle body inlet elbow will have a threaded fitting for a 3/8” NPT air temperature sensor (for FMII turbo kits). If you have this fitting and are not installing a sensor in that location, plug it with a 3/8” NPT plug that has Teflon paste (or tape) on the threads. NPT threads are tapered so the male and female thread will bottom out against each other before bottoming out on anything visible. On 90 - 97 cars, weave the built-in IAC hose onto the IAC valve. Once it’s in place, tighten down the hose clamps. You’ll have three 2.75” clamps (36-70308 / 288) to use, one at the top of the intercooler outlet hose, one at the bottom of the throttle body inlet elbow, and one at the throttle body. On 90 - 97 cars only, use the 14-27mm hose clamp (36-70005) to hold the IAC hose on the IAC valve. 94-97 cars have a similar IAC hose / setup to 90-93, although the hose is on the opposite side.

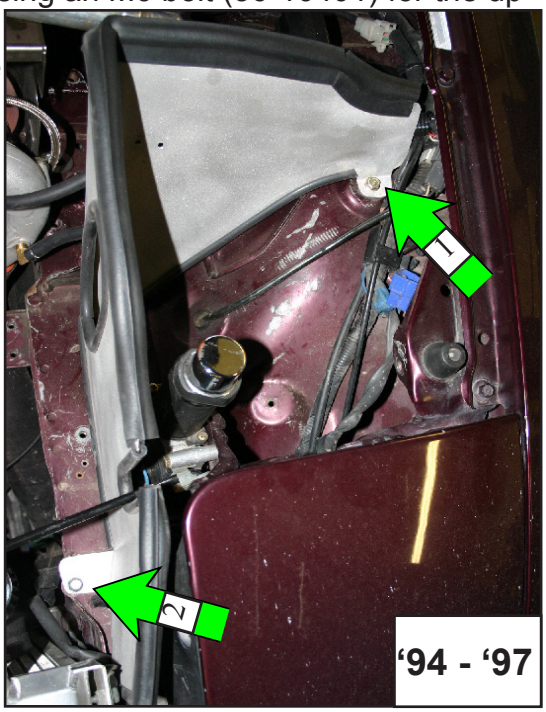


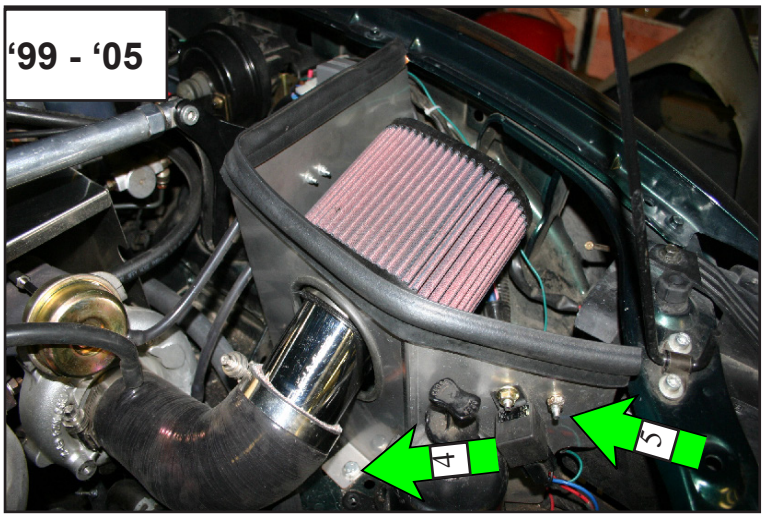


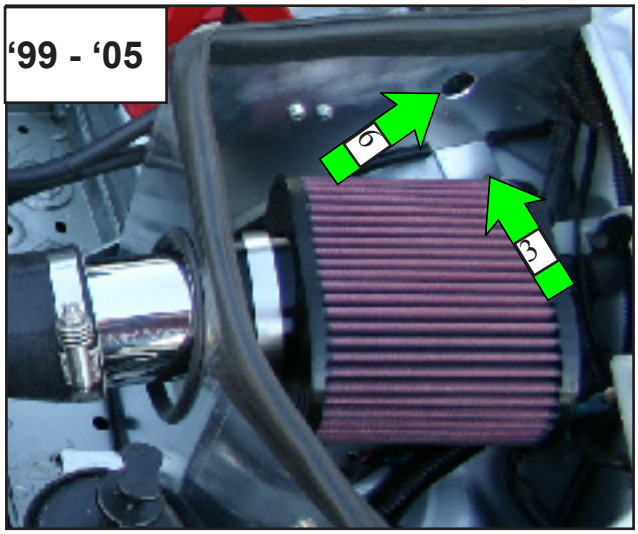
4. Mount the bypass (blow-off) valve to the throttle body inlet elbow using the built-in 1-3/8” silicone hose. Hold the valve in place using one of the 33 - 57mm hose clamps (36-70030). Be sure that the outlet on the BOV points down, as it does in both pictures. This hose clamp can be tightened now. Leave the outlet open for the time being; the BOV will be plumbed in the next section. The Turbosmart BOV is unique in that you can spin the nipple for the vacuum line without loosening anything. Do so to ensure the best orientation when you connect the signal line (section 18).

Air box and compressor Inlet
Bags to use: #6A, #7A

1. A few edges of the air box need to be lined with edge trim (36-90060) to prevent any rattling and to further seal against heat. The bottom edge between the two mounting holes, the hole for the air filter mounting pipe, and the front-most vertical edge will all need to be lined. If the trim pulls away, secure it with a glue, such as the silicone sealant in the parts list.
2. **'94 - '97 Cars Only:** Bolt the aluminum air box into place, using an M6 bolt (36-10401) for the upper mount (1) and the M6 bolt (36-10401) under the power steering reservoir (2) for the lower mount. Remove all of the black plastic trim that is found on the bottom of the hood around the headlight cut-out.
3. **'99 - '05 Cars Only:** Bolt the aluminum air box into place, using the M6 bolt for the rear hole (3), and the M8 bolt supplied for the front hole (4). Mount the relays to the air box (5) using the holes in the front of the air box. The relays mount to both sides of the air box - two on the inside, one on the outside.
4. Fit the rubber gasket (36-90050) around the top of the air box to seal against the hood. Gently close the hood and make sure the air box does not interfere with the hood. The top of the air box may need to be trimmed to fit under the hood.
5. **'99 - '05 Cars Only:** The OEM air temp sensor will need to be reinstalled. Press it into the appropriate hole (6) in the new air box and reconnect the wires to it.

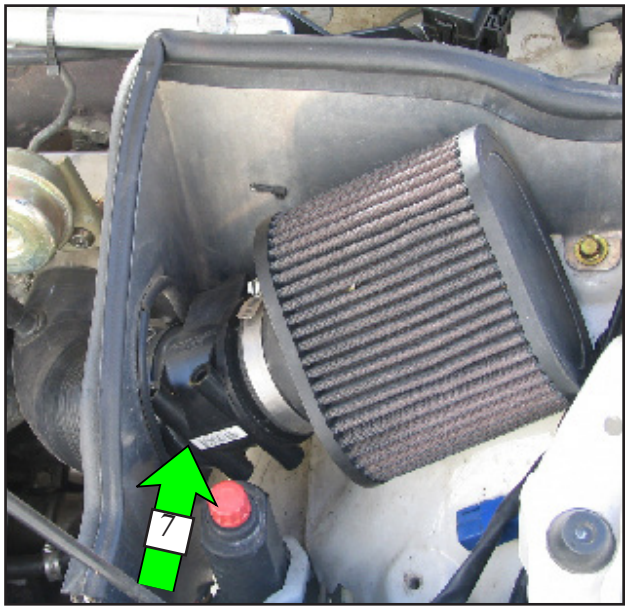




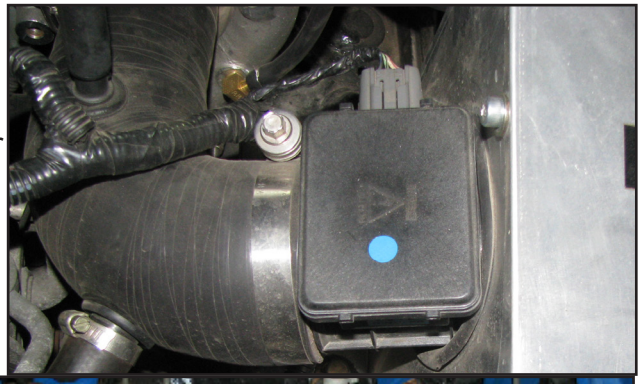


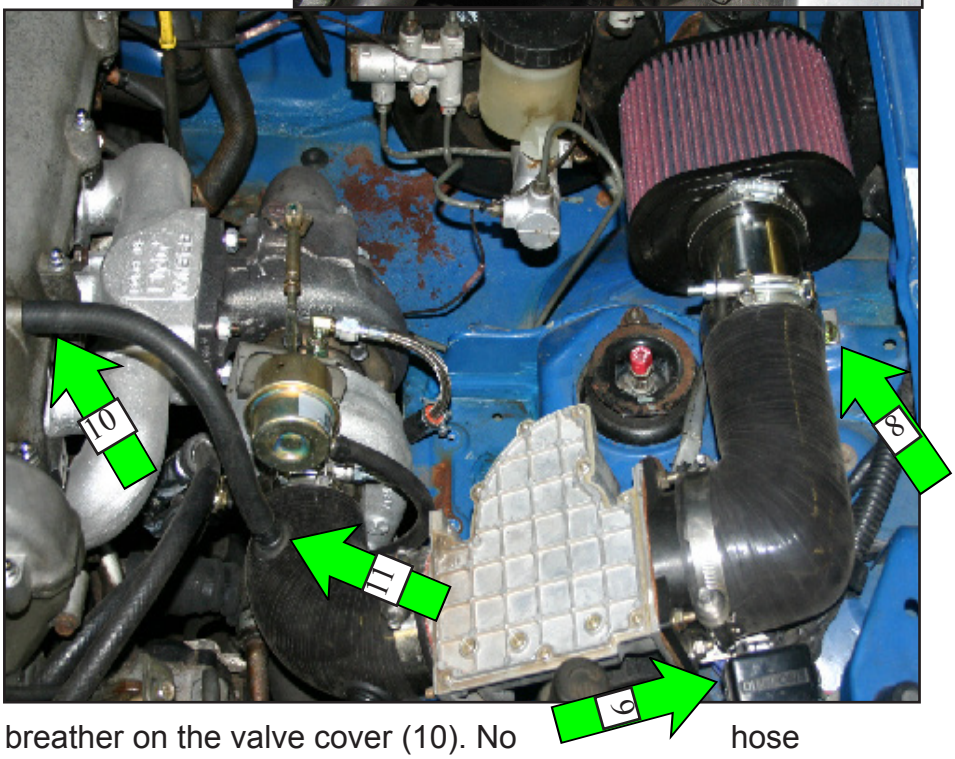
6. Attach the compressor inlet hose (22-504XX) to the compressor inlet on the turbo with the 52-76 constant torque hose clamp (36-70040). This hose is the 90° elbow with a built-in hose. Most inlet hoses also have an aluminum bung for connecting the bypass valve hose. Just be sure the other end of the aluminum bung pipe (within the silicone hose) is pointing toward the turbo. The compressor inlet hose will have a longer straight section on one end, this end connects to the compressor. The clamp can be snugged, but leave it loose enough to allow rotation about the compressor. You may have to trim a little bit off the turbo side, do so if the inlet doesn't line up with the air box.

7. **‘94 - ‘05 kits only:** Attach the factory mass airflow sensor (MAF, 7), next page to the compressor inlet hose. Make sure the MAF lines up with the large hole in the air box. Be gentle at this connection. No boost is seen at this connection and if the clamp is tightened too hard the plastic could break and be sucked into the turbo. Note that the MAF is directional. Be sure that the arrow on the side points in the direction of the airflow (towards the turbo). On ‘99 - ‘05 cars, make sure the heavy screen in the airflow meter is toward the air filter. ‘94 - ‘97 cars do not have a screen. ‘94 - ‘97 cars also need to have the rubber gasket on the filter side discarded. The wires will be routed in a later step. ‘94 - ‘97 MAFs sit mostly inside the air box (upper picture), ‘99 - ‘05 MAFs sit mostly outside (lower picture).



8. **‘90 - ‘93 kits only:** Connect the factory airflow meter to the compressor inlet (22-504XX). The meter will need to be upside down. Attach the included adapter (05-90000) to the opposite side of the meter. Be sure to put the diagnosis box adapter (22-31050) between the meter adapter and the nut, on the front lower stud. Remove the diagnosis box from its mount, then remove the mount. Attach the hose with a sharp bend (22-50500) to the adapter - the end with the sharp bend will connect to the adapter. Next, connect the support (22-40215) to the hose, then attach it to the chassis where the diagnosis box was previously attached (8). Finally, route the wires for the diagnosis box, and the diagnosis box itself, over to the previously installed adapter and secure it (9).

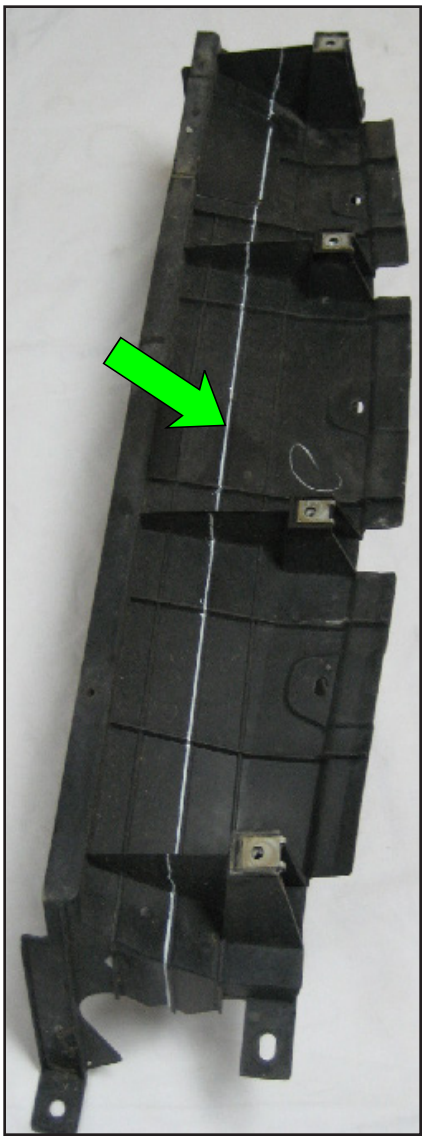


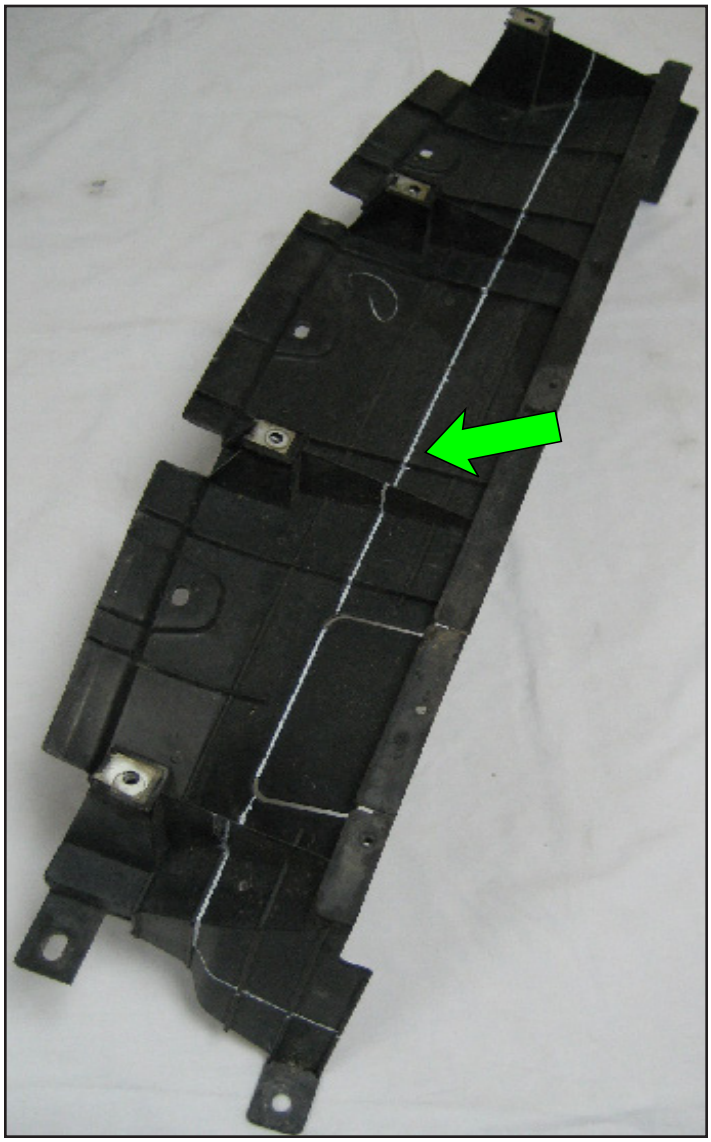


9. **’94 - ‘05 kits only:** Secure the air filter to the MAF. Adjust the connections at the compressor and air filter to best locate the air filter in the air box. Be sure that the air filter does not contact anything other than the mounting pipe. Once everything is aligned, tighten both clamps. On ‘94 - ‘97 cars, be sure that the filter is all the way on the MAF, as it will most likely get slightly hung up before slipping all the way on.
10. Connect the 3/8” hose that’s built into the compressor inlet hose to the breather on the valve cover (10). No hose clamps are needed on this hose. This hose is left long so that it can be routed to a catch can / air/oil separator if so desired. It can be cut short to fit better, or left long.
11. Route the wires for the airflow meter/MAF over to it. The ‘94 - ‘97 cars should have the wires come under the lip of the fender - around the air box - and then connect to the MAF. The MAF wires for the ‘99 - ‘05 cars should come through the hole in the air box - wrap tape around the wires to ensure that they won’t be cut by the air box. If necessary, secure the wires.

Trim Mouth/Radiator Inlet Duct for 90-97 Cars

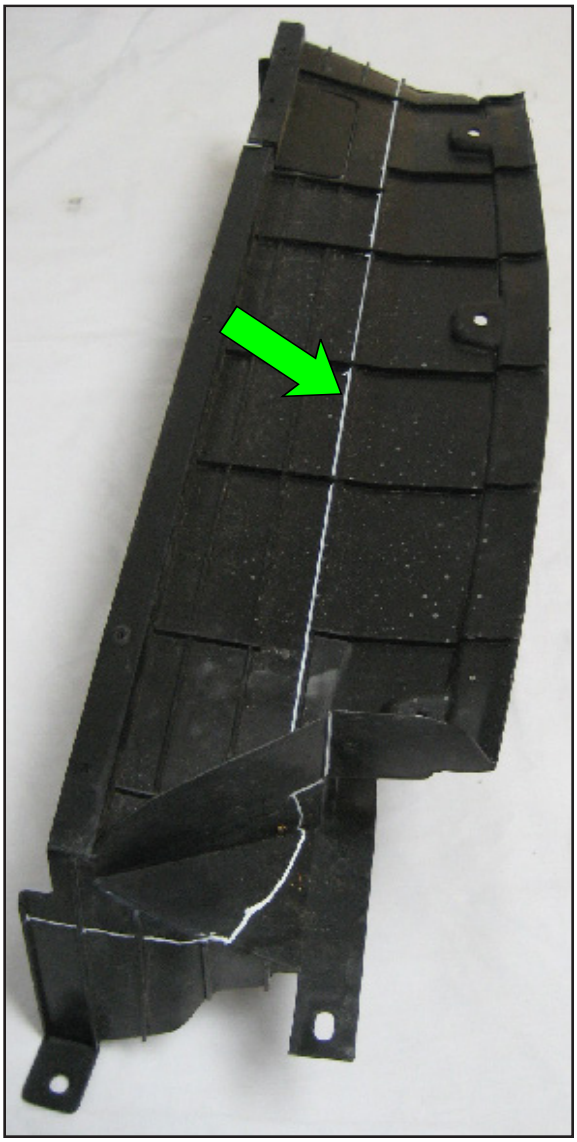
1. First off, determine which type of mouth you have. If your car has ABS, the left side of the mouth should look like the picture on the left, with the cutout between the mounting tabs on the side. Otherwise, both sides should look like the picture on the right. If your mouth has the cutout, as the mouth below does, follow these directions. If it does not, and the mouth is symmetrical, follow the right side directions for both sides. Before you start cutting, it's usually a good idea to take a paint pen or marker and trace out where you're going to cut. The cutting should start after you're satisfied with the layout. A pneumatic hack saw is the best tool for this job, but metal shears are a more common second place. There's a good chance that further trimming will be required after the mouth has been test fit.
   1. **Left Side:** Find the second rib from the front - refer to the picture - and begin the trimming there. This rib will be followed down the left side and across the middle.
   2. **Right Side:** Do not follow the second rib all the way up the right side. The second rib should be followed up the right side for about 4", starting at the bottom. From the stopping point, cut towards the back of the mouth at a 100° angle, relative to the previous cut. The mouth may require additional trimming, but it should be test fit at this point. The mouth can be close to the hoses, but it shouldn't touch any of them. Trim any of the edges that are doing this.





Trim Mouth/Radiator Inlet Duct for 99-05 Cars

1. Before you start cutting, it's usually a good idea to take a paint pen or marker and trace out where you're going to cut. The cutting should start after you're satisfied with the layout. Metal shears seem to be the best tool for this job. Starting at the right side of the mouth, cut into it at a point on the vertical face that is 3-3/4" down from the rear mounting point. Cut straight across until you get to the middle rib, then angle down so that your cut finishes right where the first rib (from the front) turns to go under the mouth. At that point, follow the first rib all the way across the mouth. Once you get to the end of the first rib, cut vertically at the closest corner between the two vertical faces, then connect the two cuts. Now cut the vertical face at the end of the first rib. Once you get to the next face, angle the cut towards the back of the mouth, so that it will end where the second rib (again, from the front) terminates at the face you're cutting. Cut straight back from that point. The arch will be retained, but the two arch supports will need to be trimmed. The mouth should be test fit at this point. The mouth can be close to the hoses, but it shouldn't touch them. Trim any edges that are too long.



Trim Splash Pan '90 - '97 Cars Only

1. Unfortunately, trimming the splash pan is not quite as straightforward as trimming the mouth. There's more experimentation involved here. Remember, if in doubt trim less, not more. It's a lot easier to take material off than add material back on. As with the mouth, mark out what you're going to cut before you cut it. Try to make sure that your layout looks similar to the layout in the picture. The splash pan will almost definitely require additional trimming, don't expect it to be right the first time. Once the splash pan has been trimmed completely, leave it off the car. Re-install it after your first test drive, once you're certain that nothing else will need to be tweaked. The splash pan is important for cooling and protection, so please don't leave it off.
2. Start on the left side first, as it's the easiest side to modify. A pneumatic hack saw is the best tool for this job, but metal shears are a more common second place. You'll want to start cutting at the front of the pan, specifically right where the horizontal and vertical faces intersect. Cut up at an angle, so that when you get to the second bend on the vertical face the cut is about 1-1/2" off of the horizontal face. Once you get to this place, cut parallel to the horizontal face. Keep the cut parallel as the horizontal face angles down. Continue this to approximately 6" from the front edge, then begin to taper the cut up and circle around, as in the picture. The farthest edge back will be approximately 9-1/2" from the front edge. You'll want to stop the current cut and start a new cut that goes straight down, following the reinforcement for the sway bar slot. Bring the first cut around to meet up with the second cut. Again, this is just a rough place to start from, further trimming will be required. Refer to the pictures for clarification. The other side will have to be cut before the pan can be test fit.

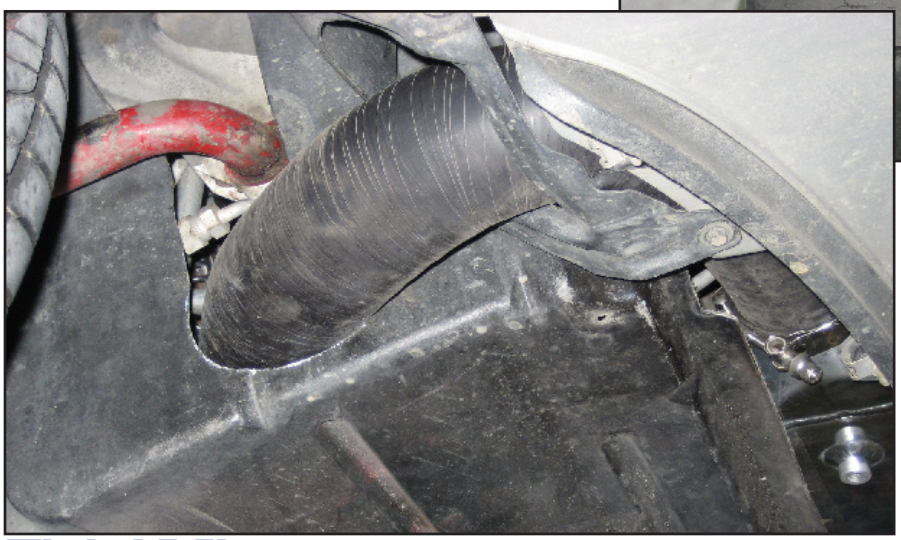
3. The right side of the splash pan will require two separate cuts. The forward cut will be a relatively easy trim, while the rear cut will be a little more involved. The easiest way to determine the right shape for both cuts is to use the outside of one of the larger (2-1/2" I.D.) intake hoses. The bottom edge of the hose should be flush against the bottom edge of the splash pan, and the rear edge of the hose should be about 1-1/4" off of the forward edge of the splash pan. The cut should taper out towards the top. The edge of this cut that runs along the bottom of the pan should line up with the rear edge of the right-most oval hole in the front of the pan. The cut should run up to this hole on the right, then taper out quickly on the left of the hole. The large hose should also be used to mark out the second cut. The rear edge of the rear cut will be approximately 5-1/4" off of the rear edge of the splash pan. When you're lining up the hose to mark out the cut, the bottom edge should be flush with the bottom edge of the splash pan. Once that part is marked out, move the hose so that the forward edge is 4-3/4" from the rear edge that was just marked. This will make the slot 4-3/4" wide at its widest point. The bottom edge of the hose should still be flush with the bottom edge of the splash pan. Connect the bottom edges of the markings just put down. On the rear edge of the slot, connect the rear edge of the marking just drawn with the rear edge of the sway bar slot. The front edge of the slot should wrap around to meet up with the front edge of the sway bar slot. Two half circles will probably need to be cut to clear the mounting bosses on the bottom of the intercooler. Mark and cut these after the rest of the pan is complete. Again, these guidelines are just a rough start, further trimming will almost definitely be needed. Please look at the pictures to clarify any questions. NOTE: The forward piece that will be left after trimming will be difficult to fit between the two segments of the intercooler out hose. Since the hose is flexible, that portion of the pan can often be finagled into position by bending the hose a little. If not, there are two options. The easiest option is to trim more of the pan off, but it's preferable to leave as much of it intact as possible. The second option is to remove the intercooler outlet hose from the intercooler, install the pan, then re-install the hose. The hose can be difficult to re-attach, but it is possible. On some cars it's easier to put the hose clamp on the intercooler, get the hose over the lip of the intercooler, then slide the hose clamp onto the hose. Finally, slide the hose the rest of the way onto the intercooler and tighten down the hose clamp.

Trim Splash Pan '99 - '05 Cars Only

1. Unfortunately, trimming the splash pan is not quite as straightforward as trimming the mouth. However, there is only a little variation between the two generations, the dimensions are basically the only things that have changed. As with the first generation, more experimentation will be required to get the proper fit. Remember, if in doubt trim less, not more. It's a lot easier to take material off than add material back on. As with the mouth, mark out what you're going to cut before you cut it. Try to make sure that your layout looks similar to the layout in the picture. The splash pan will almost definitely require additional trimming, don't expect it to be right the first time. Once the splash pan has been trimmed completely, leave it off the car. Re-install it after your first test drive, once you're certain that nothing else will need to be tweaked. The splash pan is important for cooling and protection, so please don't leave it off.
2. Start on the left side first, as it's the easiest side to modify. A pneumatic hack saw is the best tool for this job, but metal shears are a more common second place. You'll want to start cutting at the front of the pan, specifically right where the horizontal and vertical faces intersect. Cut up at an angle, so that when you get to the second bend on the vertical face the cut is about 1-1/4" off of the horizontal face. Once you get to this place, cut parallel to the horizontal face. Keep the cut parallel as the horizontal face angles down. Continue this to approximately 6" from the front edge, then begin to taper the cut up and circle around, as in the picture. The farthest edge back will be approximately 8-1/4" from the front edge. From this point, cut straight up to meet the reinforcement at the slot for the sway bar. Again, this is just a rough place to start from, further trimming will be required. Refer to the pictures for clarification. The other side will have to be cut before the pan can be test fit.

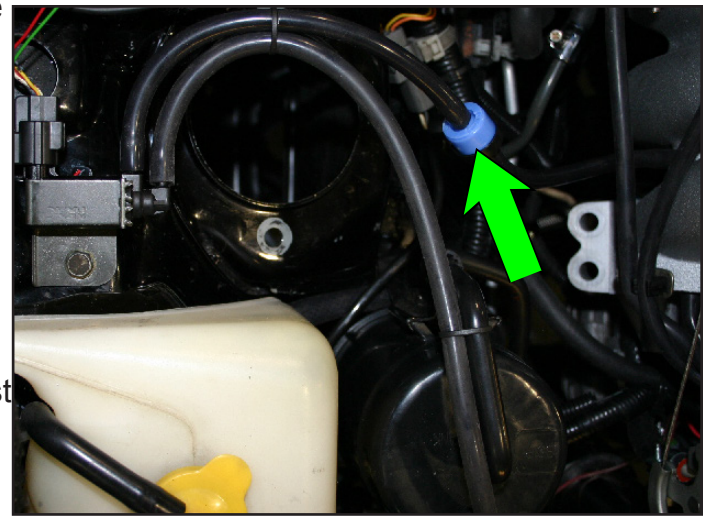
3. The right side of the splash pan will require two separate cuts. The forward cut will be a relatively easy trim, while the rear cut will be a little more involved. The easiest way to determine the right shape for both cuts is to use the outside of one of the larger (2-1/2" I.D.) intake hoses. The bottom edge of the hose should be about 1" below the bottom edge of the splash pan, and the rear edge of the hose should be about 3/4" off of the forward edge of the splash pan. The cut should taper out towards the top. The edge of this cut that runs along the bottom of the pan should line up with the rear edge of the right-most oval hole in the front of the pan. The cut should run up to this hole on the right, then taper out quickly on the left of the hole. The large hose should also be used to mark out the second cut. The rear edge of the rear cut will be approximately 5" off of the rear edge of the splash pan. When you're lining up the hose to mark out the cut, the bottom edge should be about 7/8" above the bottom edge of the splash pan. Once that part is marked out, move the hose so that the forward edge is 3-7/8" from the rear edge that was just marked. This will make the slot 3-7/8" wide at its widest point. The bottom edge of the hose should be about 3/4" above the bottom edge of the splash pan. Connect the bottom edges of the markings just put down. On the rear edge of the slot, connect the rear edge of the marking just drawn with the rear edge of the sway bar slot. The front edge of the slot should wrap around to meet up with the front edge of the sway bar slot. Two half circles will probably need to be cut to clear the mounting bosses on the bottom of the intercooler. Mark and cut these after the rest of the pan is complete. Again, these guidelines are just a rough start, further trimming will almost definitely be needed. Please look at the pictures to clarify any questions. NOTE: The forward piece that will be left after trimming will be essentially impossible to fit between the two segments of the intercooler out hose. There are two options to remedy this. The easiest option is to trim more of the pan off, but it's preferable to leave as much of it intact as possible. The second option is to remove the intercooler outlet hose from the intercooler, install the pan, then re-install the hose. The hose can be difficult to re-attach, but it is possible. On some cars it's easier to put the hose clamp on the intercooler, get the hose over the lip of the intercooler, then slide the hose clamp onto the hose. Finally, slide the hose the rest of the way onto the intercooler and tighten down the hose clamp.

4. The fender liners may need to be trimmed, but it shouldn't be anything too major. Once the hoses have been routed, whatever trimming that is necessary should be obvious.



ECU / Vacuum Line Connections
Bags to use: #7A/#7B, #8A

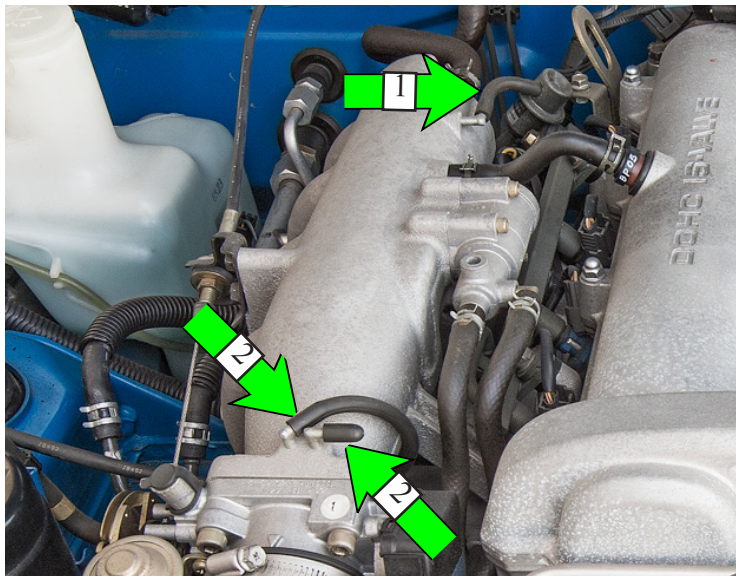
1. Insert a check valve (36-90010) in the vacuum line going to the solenoid that feeds the charcoal canister. Be sure that you put it in the correct line (the one between the manifold and the solenoid, not the line between the solenoid and the canister) and in the correct orientation (with the blue side towards the solenoid). Refer to the picture for clarification. The second check valve, if present, is used for cruise control - refer to the next section.



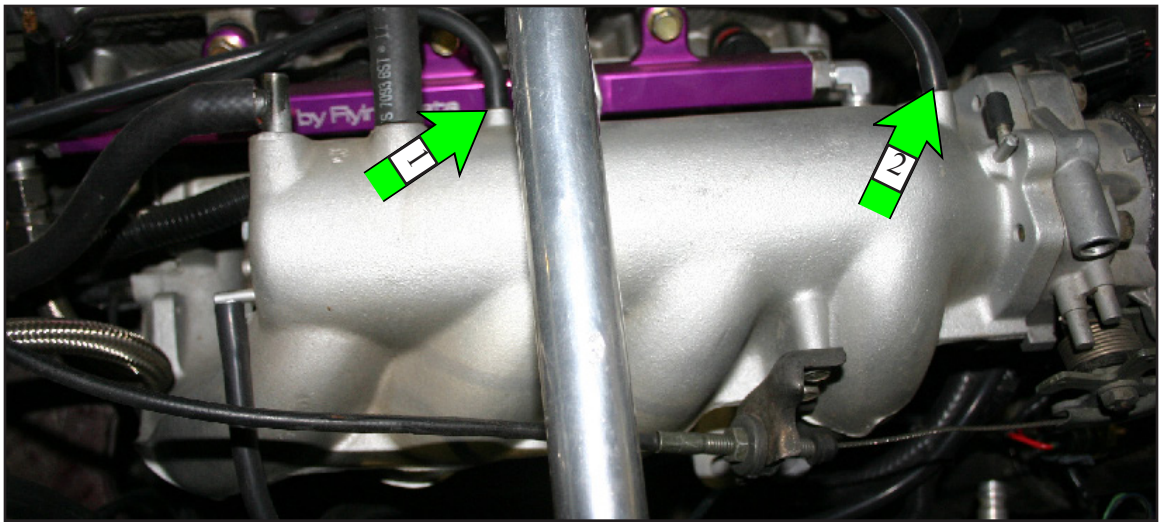
2. Use the vacuum tee (36-50250) provided to source signals for anything that needs to see vacuum or boost. This will include the BOV, boost gauge, cruise control, and MAP sensor / engine management, if so equipped. For the MAP sensor, it's very important to get the cleanest signal possible. Only sealed items with very little fluctuation (e.g., boost gauge) should share the line with the MAP sensor. Also, it is preferable to have it come into the manifold in the middle. If this is not possible, the front of the manifold is the next best thing. '99 - '05 cars have a nipple in between two of the runners that looks ideal for sourcing a signal, however, this nipple does not go through to the manifold. Don't use this to source the signal for anything. Sourcing a clean signal is not quite as critical with the other items, but you should still be sure that the signal will show both vacuum and boost. The signal line for the charcoal canister can be good for these items (e.g., BOV), the cruise control line can be a second-best choice. Be sure that there is nothing, such as a solenoid, that could interrupt the vacuum/boost between the source signal and the piece using the signal. There are examples of connections following, but they are just that - examples. As long as you have an understanding of what's needed, you can modify it as needed. The arrows are as follows:

1 = MAP line (for the engine management), boost gauge line.
2 = BOV/bypass line. This line should be tee'd into the charcoal canister line or into the cruise control line as a second best choice.

'90 - '93

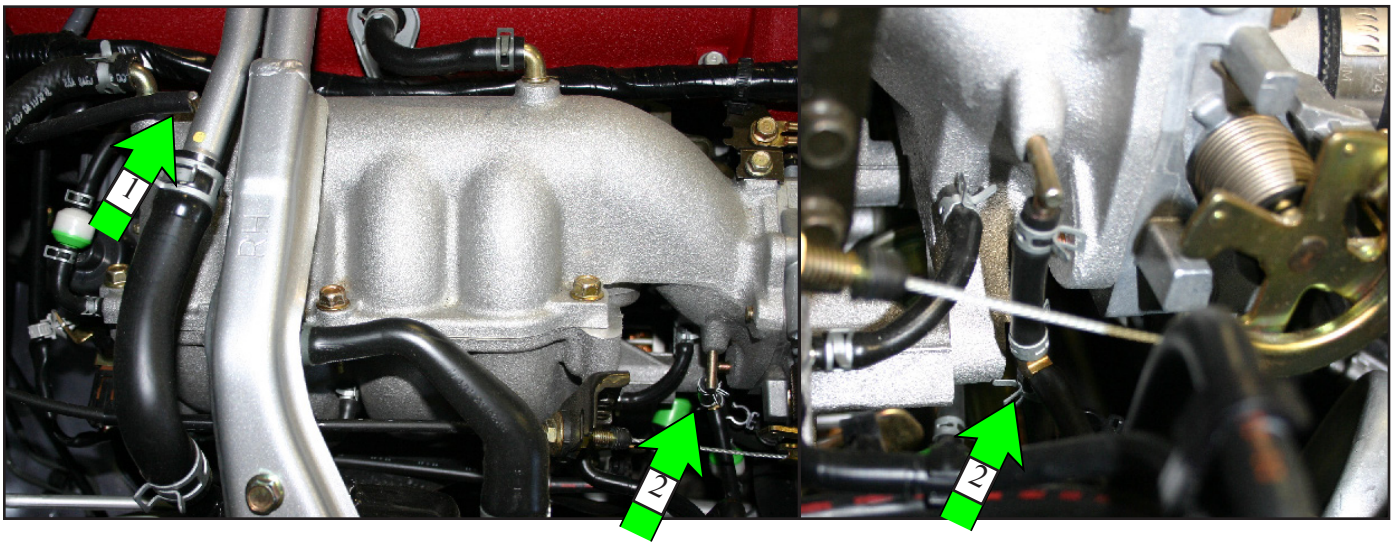


‘94 - ‘97

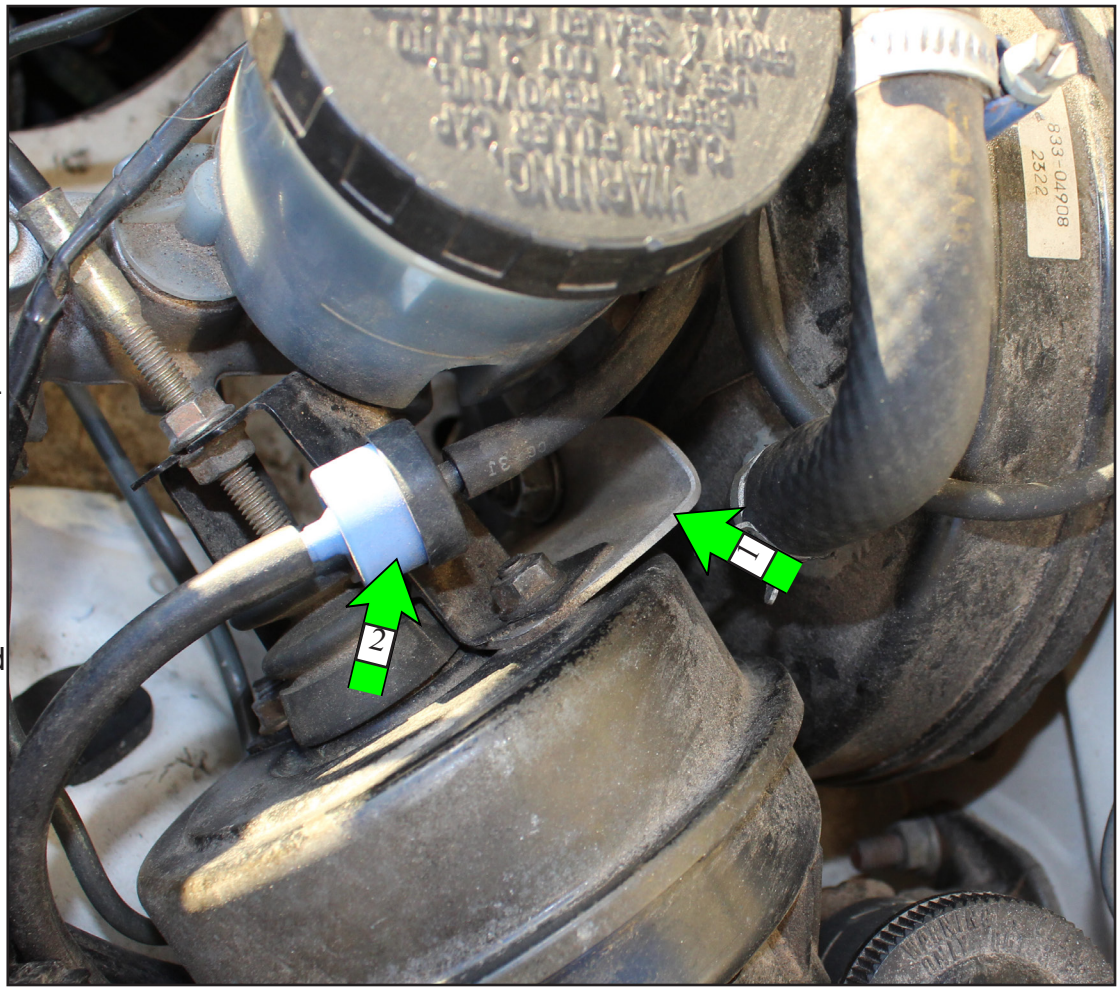


‘99 - ‘00

‘01 - ‘05



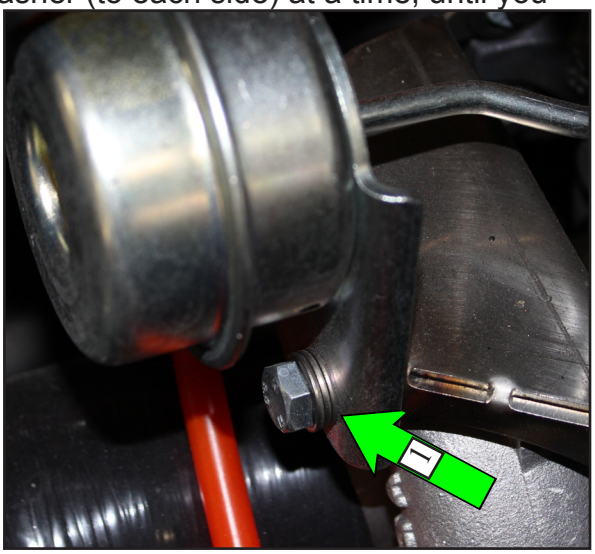
1. **94-97 cars only:** If the car is fitted with cruise control the controller has to be remounted in front of the brake master cylinder as shown below. Use the bracket (1) (02-50090), supplied with the kit. Pay attention to the routing of the cable, as it can melt if it's too close to / sitting on hot exhaust parts. Not installing the included heat shield will also cause the cruise cable to melt eventually, causing dramatic and unpleasant side affects.



2. **'90 - '93 only:** Bolt the cruise control relocation bracket onto the actuator, then bolt it onto one of the shock mount / top hat studs. Experiment with different orientations to see what fits best. Pay attention to the routing of the cable, as it can melt if it's too close to / sitting on hot exhaust parts. Not installing the included heat shield will also cause the cruise cable to melt eventually, causing dramatic and unpleasant side affects.
3. You'll need to use a check valve (2) on the vacuum line - the same valve used in step 1 of section 19. Cut the vacuum line running into the actuator in an appropriate place to locate the check valve. Insert the check valve into the vacuum line, being sure that the blue side points towards the actuator. Be sure to put the check valve immediately in front of the actuator, so that it doesn't interfere with anything else that might be teed into that line.

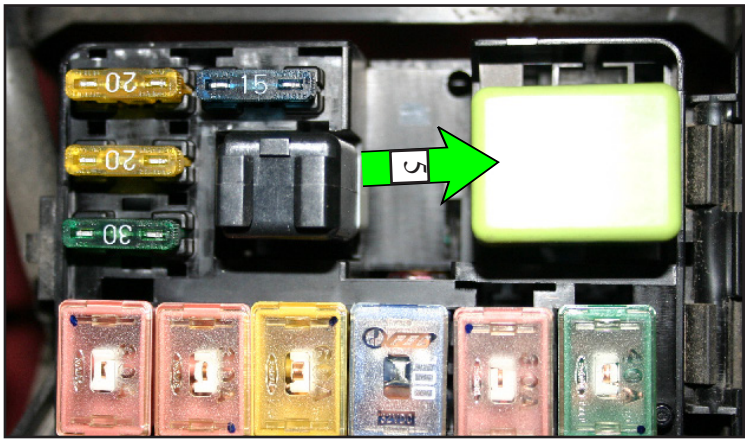
Boost Control

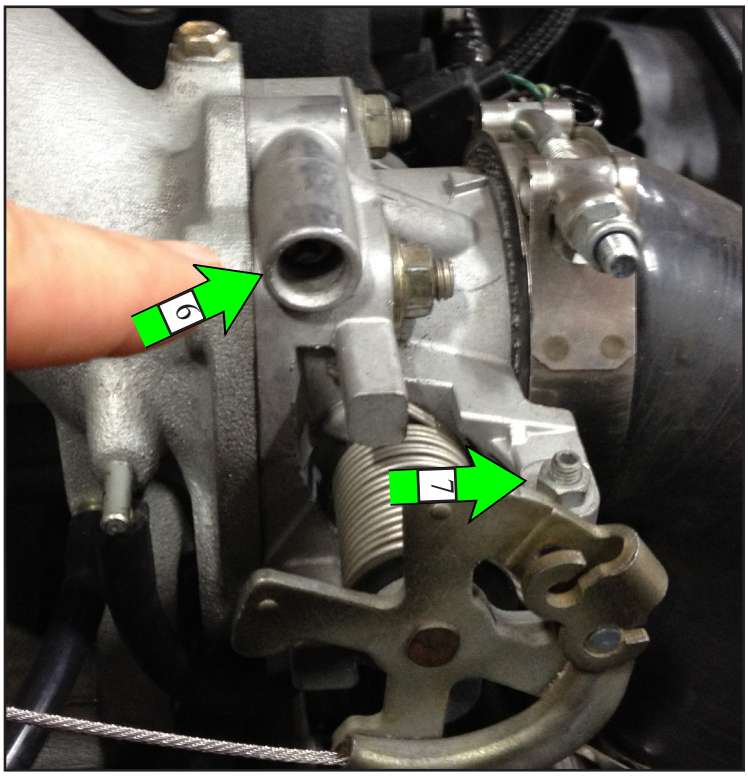
1. Connect a vacuum line from the brass barb on the compressor housing to the wastegate actuator (gold can with a rod coming out of it). Be absolutely sure that this hose can't be damaged - e.g. cut by chafing or melted by falling onto the exhaust manifold. Zip-tie the hose onto the hose barbs, to ensure that it doesn't blow off.
2. The base boost (the boost reached mechanically by the wastegate actuator) must be properly set. This needs to be done before the heat shield is installed. Generally speaking, 90-00 cars should run 6 - 8 psi, 01-05 need to stay around 6 psi. The wastegate actuator should be around 6 psi, but will vary based on a number of factors. It's not really possible to get less boost (read the additional information note below for a qualifier), but you can get higher boost. Once the car is ready to drive, take it out for a spin - remember, turbos are load driven, so you can't set the boost by revving the engine, you must drive it. Keep a close eye on the boost, and watch where it settles.
3. The true deciding factor in how much boost you can run is your air:fuel ratio (AFR). Ideally, this would be around 10.5-11.5:1 at wide open throttle (WOT), but no leaner than 12.5:1 (higher numbers = leaner). Your AFR should be based on what a wideband oxygen sensor tells you, NOT what a gauge for a narrow band (stock) oxygen sensor says. Your stock oxygen sensor can't be trusted to give an accurate value under richer AFRs. Adjust the boost per step 4 until your AFR at WOT is appropriate. The numbers will bounce a fair amount, so you're looking for an average, not an exact value. Do not run more than 8 psi, regardless of the AFR you're seeing.
4. If you need to increase the boost, add a washer underneath each bolt holding the wastegate actuator to the bracket (in the picture they're not increasing the boost (1)). The washer will need to be placed between the actuator and the bracket. Add one washer (to each side) at a time, until you achieve your target boost. Bear in mind that your boost will increase during colder weather, as the increased air density increases the boost level. In order to install the washers, you'll first need to remove the C-clip that holds the wastegate actuator to the wastegate. Be careful with the C-clip, as they're very easy to lose. You should hold a magnet next to the C-clip as you're removing it, otherwise you're likely to lose it. Keep in mind that this is something of a trial-and-error procedure. If adding one washer doesn't produce enough boost, add another one (again, to each bolt). Increasing the boost should be done in conjunction with observing your AFR at WOT so that you can be sure you have the capability to fuel the increased boost.



Additional information about boost levels:
Decreasing the backpressure in your exhaust can increase the boost level. If you are running too much boost for your setup (e.g., your air:fuel ratio is over 12.5:1). You can decrease the preload by moving the wastegate actuator towards the turbine - that means washers between the bracket and the compressor housing. Don't loosen it too much, as that will result in slow spool / more lag - the wastegate actuator arm should always have at least some preload to it.

Final Touches

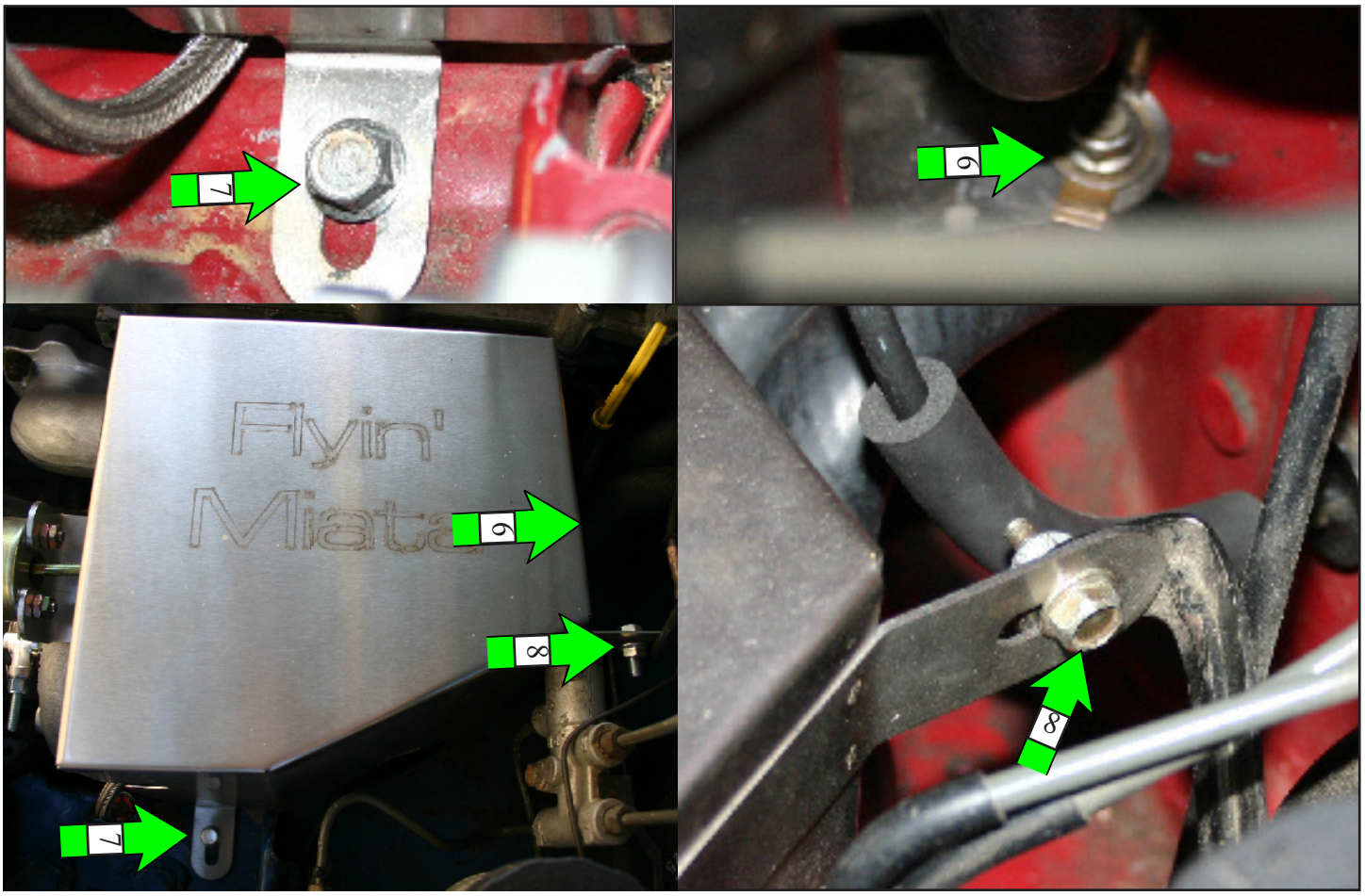




1. **99-05 ABS cars only:** Install the new windshield washer bottle, following the instructions that came with it.
2. Remove the spark plugs and set the gap down to .028". If the car still misfires, decrease the gap (to a minimum of .025") or replace the wires. You can try a bigger gap, but it's typically more effort than it's worth. We've had the best luck with a combination of Magnecor 8.5mm wires and NGK ZFR6F-11 plugs. Other products - wires in particular - we've seen have been much more likely to misfire. Flashy "performance" wires are still prone to misfires, the Magnecors are the only reliable wires we've found.
3. Reinstall the oil drain plug, then fill the engine with oil. Reinstall the coolant drain plug and refill with the appropriate coolant mixture. DO NOT use more than 50% antifreeze, as this will cause overheating. 70% distilled water, 30% antifreeze is usually a good ratio, but this will vary based on your particular winter conditions - check to be sure you'll be safe. Bleeding the coolant is typically easiest to do with the nose of the car as high as possible.
4. Once all electronics are installed and the battery has been reconnected, you'll need to prime the turbo. Remove the main relay (5) - there are no clips holding it in, a screwdriver can be carefully used to help pry it out. There's a decent chance you'll break the plastic clips, but the relay should stay in place fine without them. Crank until you see the oil pressure gauge move. Once it moves, the turbo is primed. Replace the main relay.
5. We often find that cars with piggyback engine management need to have the idle bypass screw backed out a bit to prevent idle droop and stalling. If you find that your car is doing this, back the screw out one turn at a time until the droop / stall goes away. Be sure that you're adjusting the idle bypass screw (6), NOT the throttle stop (7, small set screw and nut on the throttle mechanism). The throttle stop is set from the factory and should **NEVER** be adjusted. A '99 throttle body is shown, but they're all similar. Also, the black goop inside the throttle body, where the throttle plate sits in its closed position, is intentional and helps seal the throttle plate. **DO NOT CLEAN IT OFF.**

Heat Shield

1. Once the base boost is set, the heat shield needs to be installed. This is a fairly straightforward installation. The heat shield mounts in three locations, using the included bolts in all locations except #6. The bolt at arrow 6 should be loosened but not removed, as the heat shield is slotted there to allow for easier installation. Two of these places are on the body (6 and 7), one comes off of the brake booster.
2. The bolt that arrow six refers to is out of view in the overall picture. Refer to the pictures for the locations. Be sure that the heater hoses and turbo oil line don't contact the heat shield, as the heat shield will rub through these fairly quickly. Also, be sure the ground strap at the back of the heat shield is still connected. Be sure that the oil line does not rub on the heat shield. Secure the oil line if necessary.



General Rules of Operation

● Once you're ready, have a helper start the car while you watch for coolant, oil or fuel leaks. As the car warms up, you will likely have a fair amount of smoke as greasy fingerprints burn off and paint cures.
● Check the turbo hardware after the first few heat cycles to ensure it's not loosening up. Tighten if necessary.
● Verify your timing with a timing light. Incorrect timing can destroy an engine quickly.
● Use the best premium fuel at all times. This means 91-93 octane (R+M/2 method, which is what's used in the US).
● Do not use maximum boost for more than 30 second durations.
● If any sounds of rough combustion occur, don't use boost until the cause is identified and corrected.
● **If you hear knock from the motor, take your foot off the throttle immediately. These forces are the most damaging. For the first few drives leave the top up, the windows closed, and the stereo off. If you hear anything that sounds like marbles in the engine (i.e., knock / detonation / pre-ignition), immediately stop accelerating. You can continue to drive the car, but don't accelerate as aggressively as what caused the knocking. Once you have a chance, retard the timing a bit, and try again. Knock is more likely to occur in high-load, low-rpm situations (e.g., full throttle at 1200 rpm in fourth) and at torque peak (e.g., 4-5000 rpm in fifth gear).**
● Keep an eye on the AFR gauge from your wideband O2 sensor. The number should be about 14.7:1 at idle and cruise once fully warmed up, richer (lower number) than 12.5:1 at WOT, and will go completely lean (high numbers or dashes) when in-gear with the throttle closed and the rpm over about 3000 rpm (varies by year and application). The all-the-way-lean behavior is because the ECU turns the injectors off, this is normal.
● Be kind to your transmission and differential. The stock transmission and differential have proven reliable in turbo charged cars provided "mechanical empathy" is exercised. This means no smoky burnouts from a standing stop and no "speed shifting".
● Don't use header wrap, as it causes the manifold to crack. Using header wrap will void your warranty.
● If your car accelerates slowly but revs quickly, you've overwhelmed your clutch - time for a better one! Our Level I clutch is economical, has very friendly behavior, and holds a lot of torque (318 ft-lbs). We may be biased, but we strongly recommend it.

Maintenance

● Engine oil change interval for mineral base oils is 2500 miles. Synthetic base oils may extend the interval to 5000 miles. The synthetic oils are strongly recommended, cheap non-synthetic oils are false economy. No, really - ask the guy who had to replace his turbo. We typically use Redline 10W40. We like to change the oil once the dipstick is no longer visible through the oil on it (when you're checking the level). Check the condition regularly until you get a feel for how quickly your car dirties its oil. Bear in mind that hard use, such as track use, will wear out the oil faster. Oil catch cans / air/oil separators (that DON'T drain to the oil pan) can improve the health of your oil and future health of your engine. They can possibly extend your oil change intervals, but pay attention and be conservative.

● If you got the hard line kit, you shouldn't need to ever worry about the water or oil lines running to the turbo. ***The hard line kit isn't compatible with 90-93 or MSM cars.*** The standard silicone / rubber water lines and oil drain should last multiple years, but they won't last forever. Briefly check them at each oil change for any weeping / cracking / brittleness. You can find generic replacements locally, but our parts are much higher quality and will last longer. If you do want to source them elsewhere, you'll need 66" of 5/16" line (preferably silicone) for the water lines and 20" of 5/8" rubber (not silicone) for the oil drain. Our part numbers are 36-40120 for the water line and 36-40231 for the oil drain.

● The air filter needs to be cleaned as necessary - there isn't a specific mileage requirement, it simply needs to be cleaned when it's dirty. It's an S&B filter, so you should clean it using their kit. You should be able to use a K&N kit if need be, but be sure not to over-oil the filter. 94-05 Stage 1 kits use filter 05-16060, 90-93 Stage 1 kits use filter 05-16070.

● The blow-off / bypass valve will need to be cleaned occasionally. If it seems to be making more noise and / or making noise on a gradual throttle closing where it didn't make noise before, it probably needs to be cleaned. Unscrew the top of the valve (use a strap wrench if necessary), but pay attention - there aren't many threads holding it in place, and there's spring tension that's going to try to eject the top. If you're not careful, it is possible for the threads to be damaged on both removal and reassembly. Remove the spring and piston, then thoroughly clean the piston and its bore. Re-oil the piston and bore using a light oil (something like Tri-Flow, don't use a thick engine oil), and reassemble. Again, be sure to get proper thread engagement, it's easy to damage the threads if the top pushes off.

● The silicone hoses can be cleaned with ethyl alcohol. Rubber treatments will rejuvenate the outside.