Mach Performance, Inc.
4.3L Intercooled Turbo Kit
1996-2003 S-Series Trucks
Silverado & Sierra 4.3L Trucks

Mach Performance, Inc.
2002 Turbo Blazer Xtreme
at Red Rock Canyon, Nevada

Installation Overview

For best results we recommend reviewing the installation instructions beforehand and following the installation instructions closely and in sequence.

If you do not own electric fans already, please obtain them, as this will allow for the room needed to install the turbo. We recommend the stock LS1 fans over aftermarket. We have run these flawlessly for 31,000+ miles and feel that the OEM design will be more reliable, especially considering they cool a V-8 motor.

Tools and supplies needed to install your Intercooled Turbo kit:

- Basic mechanic's tool set including 3/8" and ½" drive sockets and ratchets.
- Standard and metric open end wrenches
- Adjustable wrench
- Flat and Phillips Screwdrivers
- Spark plug socket
- Drill motor and hole saw for notching the driver's side inner fender well
- Cutting tool to notch battery tray
- 3/8" NPT pipe tap for tapping oil pan
- 6 non-platinum spark plugs if current plugs are more than one year old or have more than 10,000 miles on them. DO NOT use platinum plugs. We recommend AC/Delco R42LTS or equivalent.
- Factory replacement fuel filter if it's been more than 10,000 miles
- Teflon paste
- Hi-Temp Ultra Copper Gasket Sealant
- Anti-seize paste (all can be found at your local hardware store or home improvement stores).
- Wire ties
- Jack Stands and Jack

Ideally you should also have the following gauges available to properly check the finished installation and monitor your vehicle's performance, (especially for racing applications):

*Boost Gauge
*Full Sweep 0-100psi Fuel Pressure Gauge

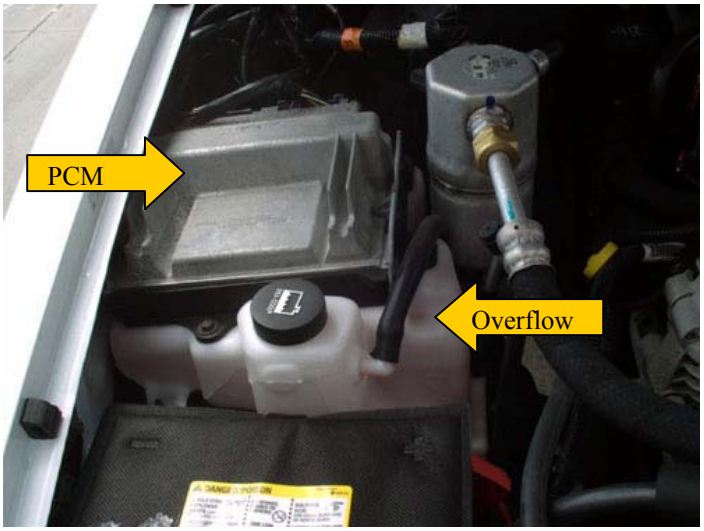
Both gauges should be mounted so that they can be seen from the driver's seat. In order to obtain usable readings, the gauges should measure pressure at the intake manifold.

The engine on which the Turbo System is to be installed should retain the factory compression ratio. If it has been modified in any way, please consult Mach Performance, Inc. before proceeding with the installation. This turbo system is intended for use on a strong, well maintained engine. Installation on a worn or troublesome engine should be reconsidered. **Mach Performance, Inc. will not be held responsible for damage to an engine.**

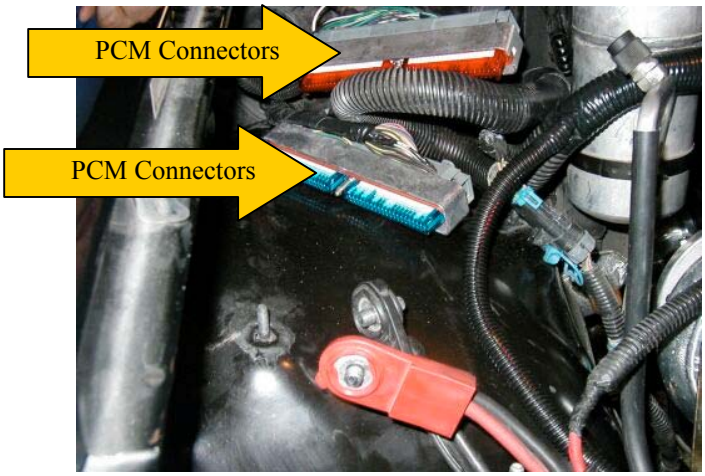
NOTE: Read and understand all instructions and safety precautions in this manual before installation. Failure to comply with instructions in this manual could result in personal injury, property damage or damage to the new system. If after reading these instructions, you are unsure of your skills, we recommend a professional shop experienced in such field install and tune this system.

Preparation for Installation

Place vehicle on four jack stands or on hoist. Make sure the truck is safely on jack stands before climbing underneath. This will allow for the front tires to drop giving you the room you need to install the exhaust components. Disconnect and remove battery from vehicle. Remove battery tray so it may be clearanced to provide clearance for battery cables near the compressor housing. Cut away the amount shown carefully with proper tools. Set tray aside until the end of the install when it may be reinstalled with the battery.

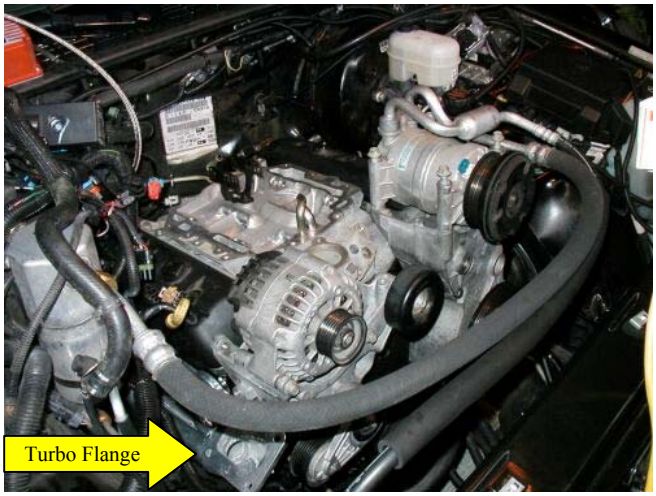


Remove PCM and stock overflow tank. Set the PCM aside until the end of the install when it may be reinstalled to the fender-well. The stock overflow tank will be replaced with the supplied black overflow can, bracket, hardware and hose. This will now be mounted onto the core support behind the grill. We found this to be the inconspicuous placement and frees up having any more clutter under the hood. See the following pictures:



Header & Crossover Install

After removing the spark plug wires and spark plugs, remove exhaust manifolds and Y-pipe. Begin mounting the headers using the supplied gaskets and supplied ARP hardware. The header with the turbo flange mounts on the passenger side. Be sure to tighten bolts securely and gaskets are lined up properly. Headers and exhaust components included in this kit will be coated with Black 2000 degree ceramic coating.

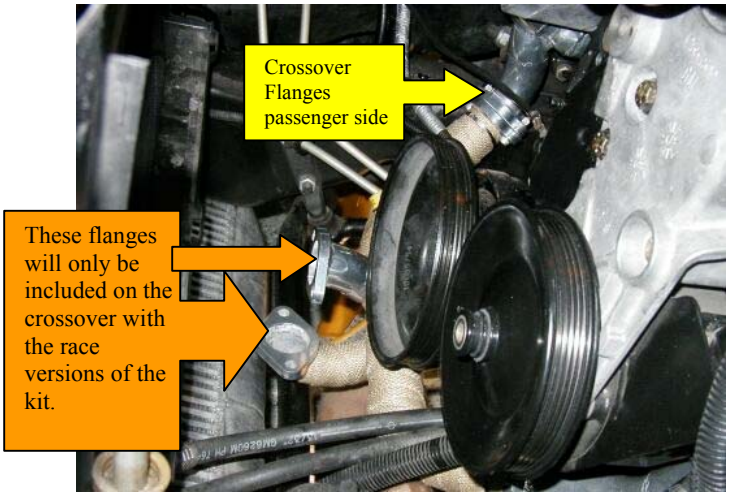


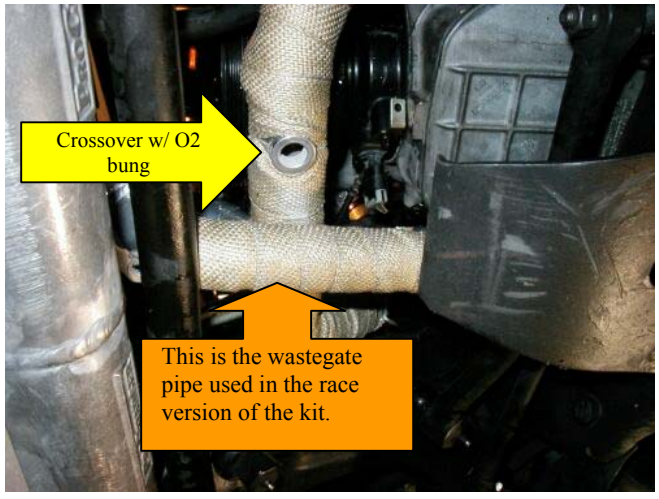
(Driver Side Header)

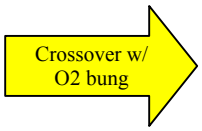
(Passenger Side Header)

At this time wrap the crossover tube with supplied header wrap and hose clamps to keep it secure to the pipe. Then, mount the crossover tube to the two headers, tying the two banks together. Use the supplied crossover gaskets and (4) SS 5/16"-18 x 2" SHCS, (4) 5/16" lock washers & (4) 5/16" nuts. Make sure to tighten all bolts very snug and gaskets are lined up properly.

NOTE: General maintenance will be required depending on how much you drive your vehicle. Bolts should be tightened on a regular basis to be sure they don't come loose or fall off from vibration.







Mount O2 Sensor here using O2 Sensor Extension supplied.

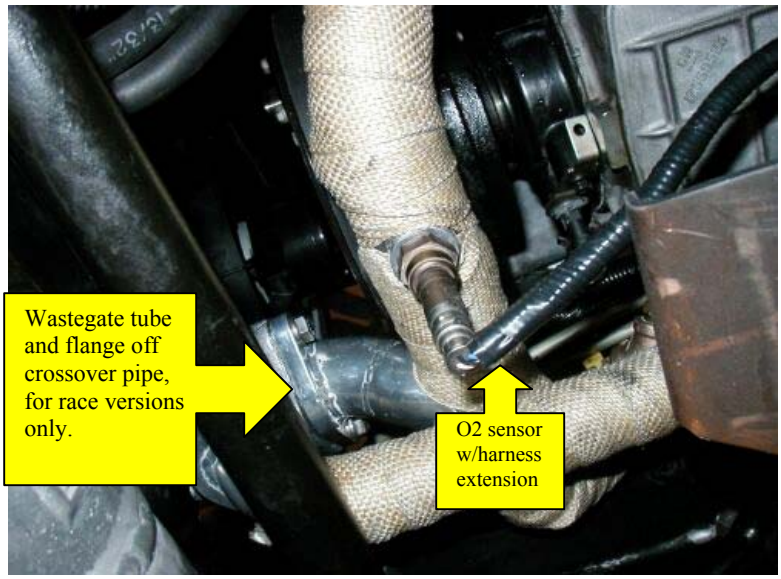
Header & Crossover Install Cont.

Attach your supplied O2 sensor harness extension into your current O2 harness from the driver's side.

***NOTE: PLEASE USE A SOLDERING IRON AND SOLDER TO PROPERLY ATTACH WIRES AND USE SHRINK TUBE AROUND THE WIRES YOU ARE SOLDERING TOGETHER. REMEMBER TO PUT SHRINK TUBE OVER ONE OF THE WIRE ENDS BEFORE SOLDERING.**

Then screw in your new extended O2 sensor into the supplied bung in the crossover tube.

***NOTE: USE ANTI-SEIZE, (WHICH CAN BE BOUGHT AT YOUR LOCAL AUTO PARTS STORE), ON THE THREADS OF ALL THE O2 SENSORS. BE CAREFUL NOT TO CROSS THREAD.**

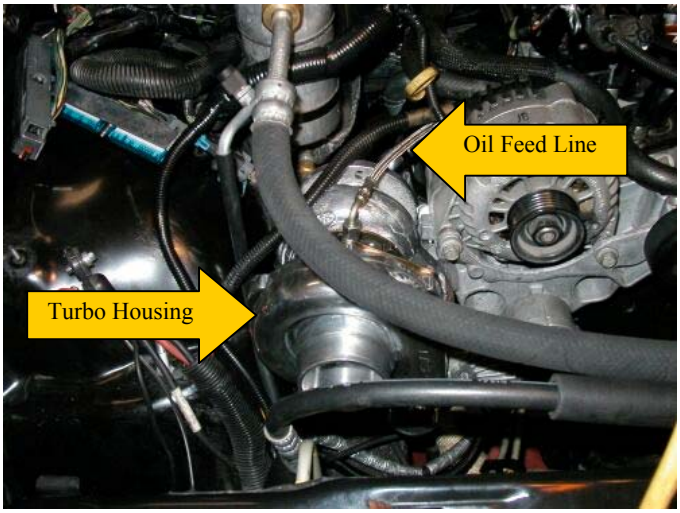


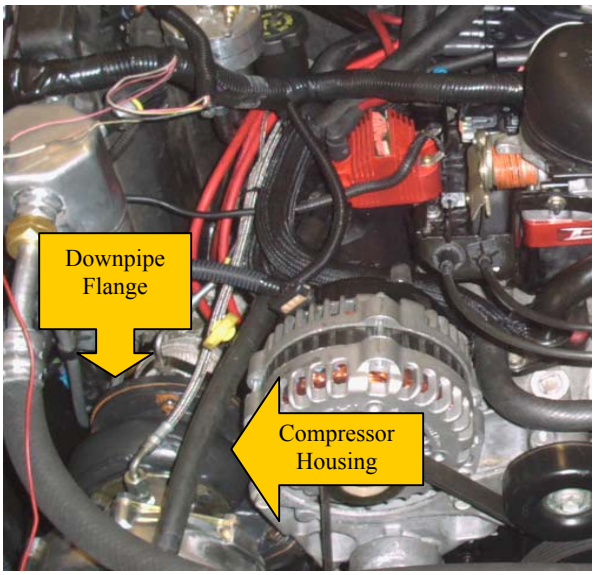
(View from underneath vehicle)

Turbo & Spark Plug Install

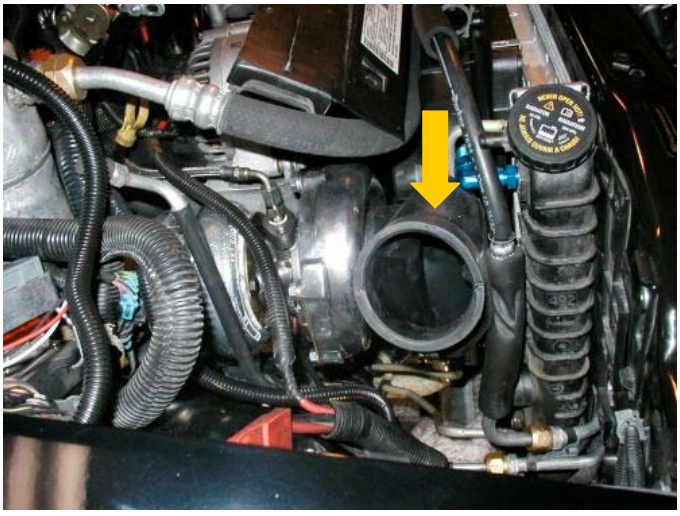
After the header install, we recommend reinstalling a new set of spark plugs. We prefer AC Delco R42LTS or NGK gapped at .035". The use of platinum plugs in a forced induction is not recommended. After the upper downpipe is in place, (*See upper downpipe installation), mount the turbo to the turbo flange using the supplied High Temp Copper Gasket in the tube, (4) metric bolts, (using anti-seize on threads), and tighten securely. Use a good size bead of gasket material around the whole perimeter of the flange, as this will be your gasket. Then mount the upper downpipe to the compressor-housing flange. *See upper downpipe installation.

NOTE: DO NOT USE METAL, PAPER OR ANY OTHER GASKET MATERIAL, AS IT WILL DETERIORATE. USE ONLY THE SUPPLIED TUBE OF HIGH TEMP COPPER GASKET. THIS MAY BE PURCHASED AT YOUR LOCAL AUTO PARTS STORE. MAKE SURE BOLTS ARE SECURELY TIGHTENED.





Once headers, crossover and the turbo are installed we recommend slightly modifying the trans cooler lines of the automatic transmissions to accommodate the cobra head inlet of the turbo. Slightly bend the lines out of the way so not to break or crack them. Install 3" Nitrile Cobra Head with the opening placed as shown, then the black, steel inlet tube and filter at end of project after battery has been put back in place.



Those who opt for relocating the battery to the back of the vehicle will have a more optimum placement of the air inlet system during track applications, although this set up has not shown to interfere with performance.

Oil Feed & Return Line Install
Tapping of Oil Pan

Oil Feed Line: Provides oil from the engine to the turbo.

1) Remove the ¼" NPT plug located above the oil filter pad on the extension from block.
2) Install supplied fitting to now vacant port.
3) Connect oil-feed line to 1/8" NPT fitting.

NOTE: DO NOT use Teflon tape or paste on the compression fittings.

Oil Return Line: Drains oil out of turbo back into the oil pan.

Tools needed to tap the aluminum oil pan for the return oil line:
3/8" NPT pipe tap (can be found at Home Depot)
9/16" Roto Broach

This is a gravity drain system. The oil-return line must be kink free, running downhill its entire length and drain into the oil pan above the oil-level line.

1) Remove the factory anti-roll bar brackets (2) from the frame and allow the bar to temporarily drop down. Unplug the factory crank trigger connector from the sensor located in the timing cover.

NOTE: Use as short a punch as possible, to ensure clearance between punch and internal engine components.

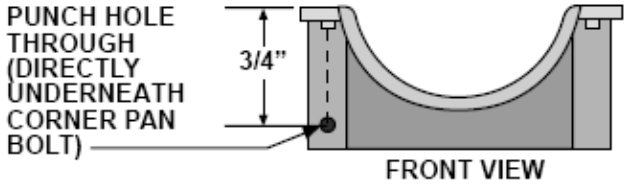
2) To provide an oil drain for the turbocharger, it is necessary to make a hole in the oil pan. Locate and mark hole as per picture. It is best to start with a center punch the hole and work up to a hole large enough to start the 3/8" NPT tap, (approximately 9/16"). DO NOT DRILL.

NOTE: 3/8" NPT refers to a pipe's inner diameter.

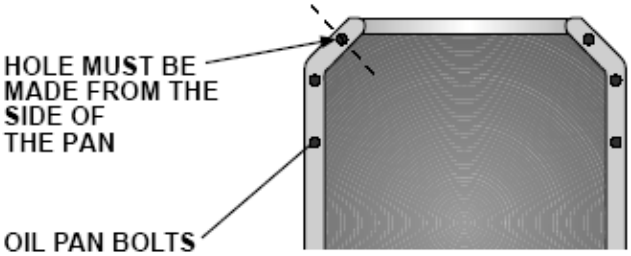
3) Pack the flutes of the 3/8" NPT tap with heavy grease and tap to approximately ½ the depth of the tap.

NOTE: This tap is tapered and should not be threaded fully into the pan.

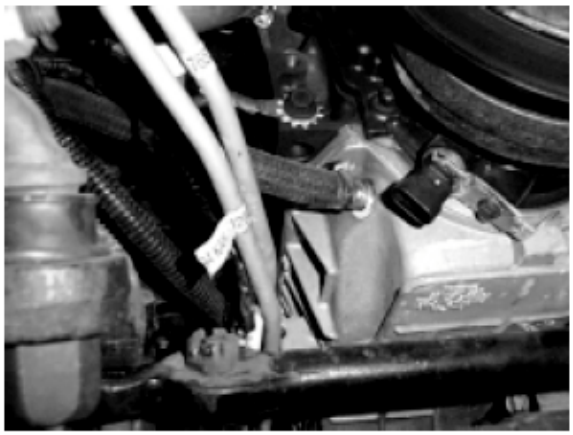
4) Clean the threads and remove any remaining chips.
5) Liberally apply silicone thread sealant and install the supplied 3/8" NPT to –8 JIC fitting.
6) Temporarily install the oil return line at this time and pour approximately ½ quart of oil through it to flush out any residue into the oil pan.
7) At this point, cover return fitting inlet to prevent any foreign matter from entering the oil pan.
8) Perform an oil and filter change.
9) Reassemble and attach to bottom of turbo. Fasten both ends securely.



FRONT VIEW



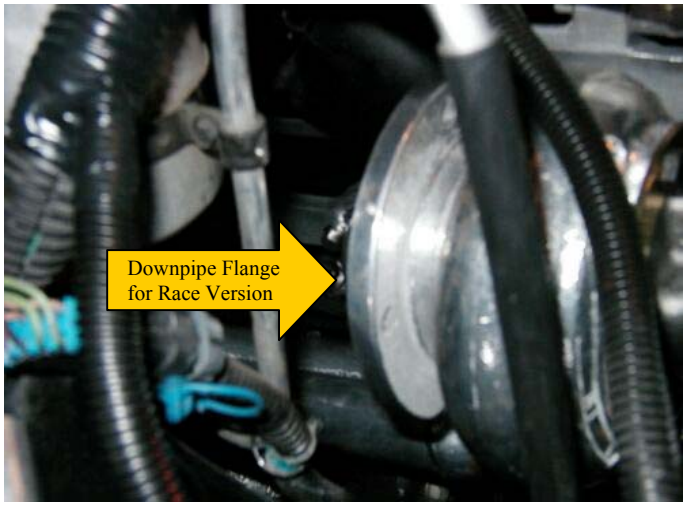
BOTTOM VIEW

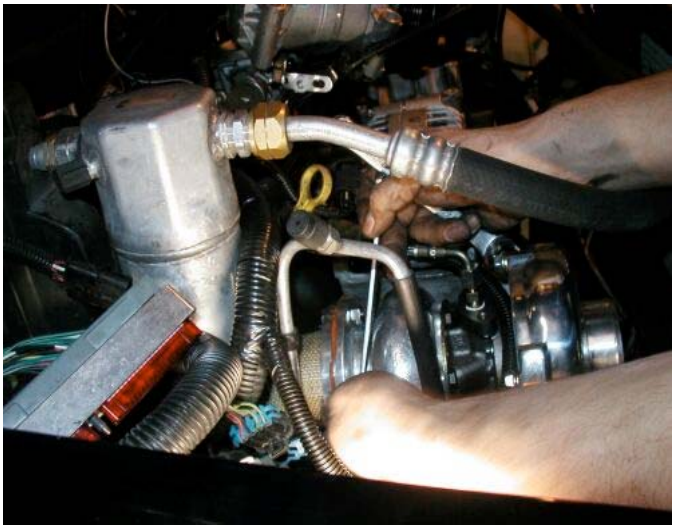


Installation of Upper Downpipe

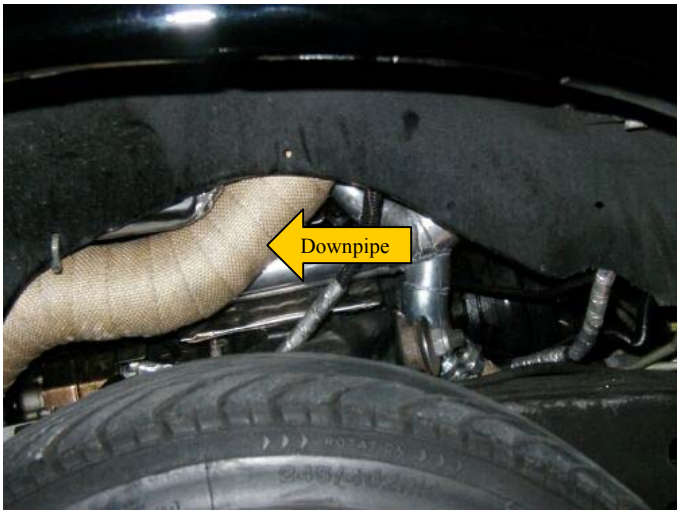
The 3" downpipe comes in two pieces. First wrap the downpipe pieces separately with the supplied header wrap and clamp ends to keep wrap tight. Prior to turbo installation, install the upper downpipe. With the truck still on jack stands, install upper downpipe section through the top of the engine compartment. Then install the turbo, making sure to use the supplied High Temp Copper Gasket on the downpipe flange as well as the turbo flange. *See page 6 for Turbo Install. Make sure to bolt the turbo down to the turbo flange first, then the downpipe to the compressor housing. Use the supplied metric bolts to securely fasten the downpipe flange to the turbo compressor housing.

***NOTE: Install lower downpipe section after turbo is installed and bolted to the upper downpipe using the supplied hardware and copper gasket sealant.**





***NOTE: Downpipe flange may be different shape between the base kit turbo and the race kit turbo. Everything still bolts together the same way otherwise.**



FUEL MANAGEMENT UNIT INSTALLATION

Installing the fuel management unit into the fuel rail return line to ensure adequate fuel pressure under boost.

The Fuel Management Unit, FMU, is a pneumatically operated fuel valve. It is controlled by boost only and is not sensitive to vacuum. The FMU is installed downstream of the factory fuel pressure regulator, therefore it is able to override the factory regulator. When manifold vacuum is present, solely the stock regulator controls the fuel pressure. As boost is building, the FMU starts to constrict the return line to the fuel tank, thus overriding the stock regulator and increases the fuel pressure in the fuel rails. This increased fuel pressure is not sensed by the car's PCM, the injectors are cycled on a normal acceleration schedule. Given that the fuel pressure under boost is now higher than stock, the engine receives more fuel during each injector pulse and the desired air/fuel ratio is established. The FMU is fully adjustable for fine-tuning and may be adjusted for different fuel pressure requirements, as well as different injector sizes. Please refer to the tuning section for details on optimizing your FMU.

WARNING: This is a high-pressure fuel system. When working on the fuel system, there will be a small amount of fuel leakage when the lines are initially disconnected. Precaution should be taken to minimize/contain this leakage. Avoid any exposure of this leakage to spark, flame or any other potential ignition sources.

1. Mark and drill two holes to mount the FMU as shown. Use the supplied #12 screw to attach the bracket to the desired location.
2. Separate the factory 5/16" fuel line at the junction near the driver's side of the intake manifold.

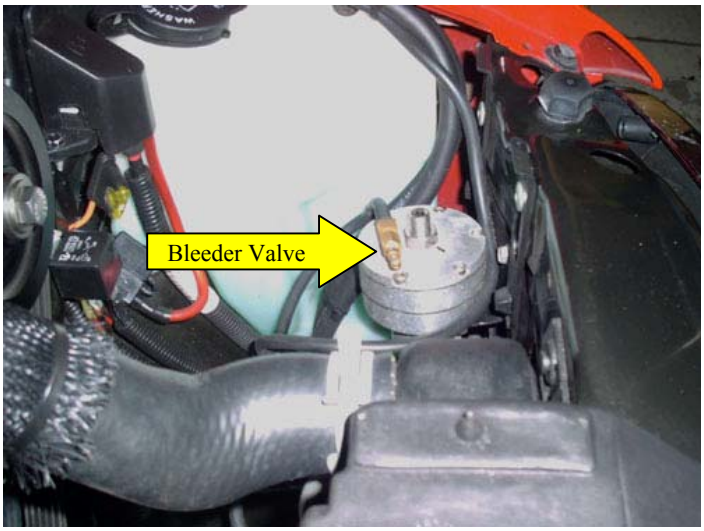
Note: The return line is the smaller of the two lines.

WARNING: FUEL IS UNDER PRESSURE. TAKE PRECAUTION TO AVOID INJURY OR FIRE.

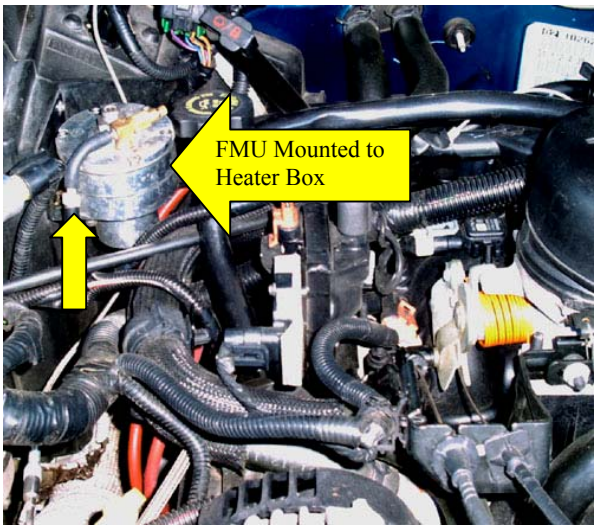
3. Connect the line from the bottom of the FMU to the factory line going to the gas tank.
4. Connect the other line on the FMU, (side), to the line coming from the return side of the fuel rail.
5. Connect one end of the supplied vacuum line to the top of the FMU.
6. Connect the other end to an intake manifold vacuum source using the supplied "T" fitting.
7. Secure the fuel and vacuum lines using wire ties.
8. Verify that the FMU needle valve is initially set in the fully closed position.
9. The top adjusting nut controls tip in fuel. There is an internal spring that applies pressure to the diaphragm, which makes the FMU more or less sensitive to boost. A good starting point is to turn the adjusting nut clockwise until fuel pressure just raises ½ -1psi above stock base pressure. This may need to be adjusted according to the vehicle's needs.
10. The small air bleed controls the rate of gain and overall fuel pressure. This is very sensitive, so small incremental turns is advised.
11. We also recommend the use of a paint marker to mark the top adjusting nut and needle valve to keep track of your settings.
12. When you are ready to drive the vehicle, we can advise you, over the phone as to how much fuel pressure you should be seeing on your fuel pressure gauge. Please feel free to call or email for tech support. (586) 468-6300 or colleen@machperformance.com

FMU Mounting Locations

These are the recommended FMU mounting locations for vehicles with cruise control.



(Mounted on Driver's Side Core Support)



(Mounted on Heater Box with self tappers)

White restrictor for FMU. DO NOT LOSE.

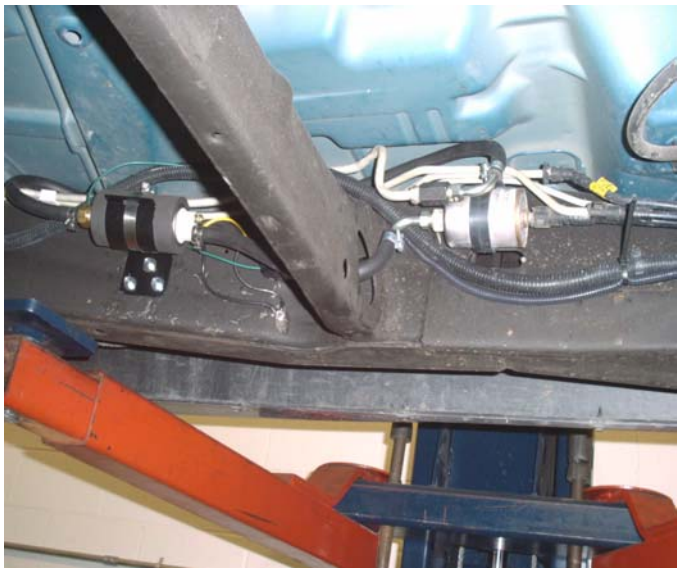
This is the recommended FMU mounting location for those vehicles without cruise control.

INLINE FUEL PUMP INSTALLATION

Description and Operation

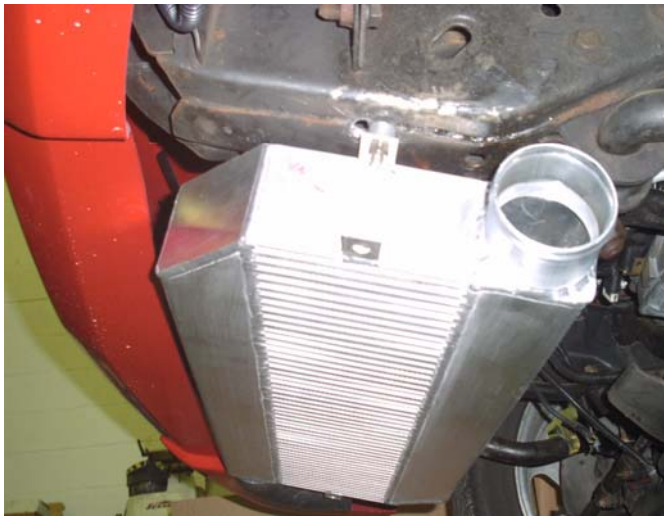
The fuel pump assembly contains a high flow, high-pressure fuel pump. It is installed in-line between the stock in-tank pump and the fuel filter, (outside the tank). The in-line fuel pump is wired into the stock pump harness and operates only when the in-tank pump operates. Since the pump's internal motor is a DC type motor, the pump output is dependant on proper input voltage, (13.5vdc), and requires correct orientation of the positive and negative power leads, (as specified near the power terminals of the pump).

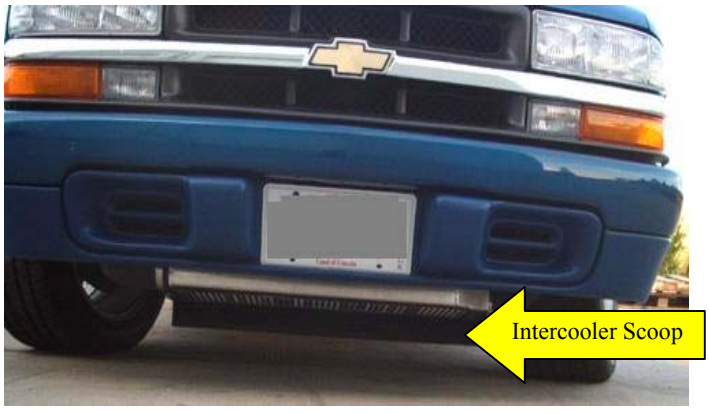
1. Raise and support vehicle as necessary to allow adequate access to the inside drivers side frame rail, just in front of rear wheel.
2. Mark and drill the holes for fuel pump mounting.
3. Using the supplied hardware, mount the pump using the grommets as an insulator between the fuel pump bracket and the frame rail.
4. Connect the fuel pump lines to the previously separated lines making sure that the pump is flowing in the proper direction. (Note: The end with the wire terminals is the pump outlet).
5. Mount supplied relay next to the fuel pump.
6. Run the yellow wire from the relay to the positive terminal on the fuel pump.
7. Attach the short black ground strap to the negative terminal on the fuel pump and run this lead and black wire from the relay to a suitable ground.
8. Using the supplied electrical tee, splice the green wire from the relay into the gray wire, which is run inside the loom on the driver side frame rail.
9. Run the red wire from the relay, up the power lugs at the fuse relay center, under the hood. The red wire should be fused using the supplied fuse holder at the power lug.
10. Secure all wiring using the supplied wire ties.



INTERCOOLER MOUNTING

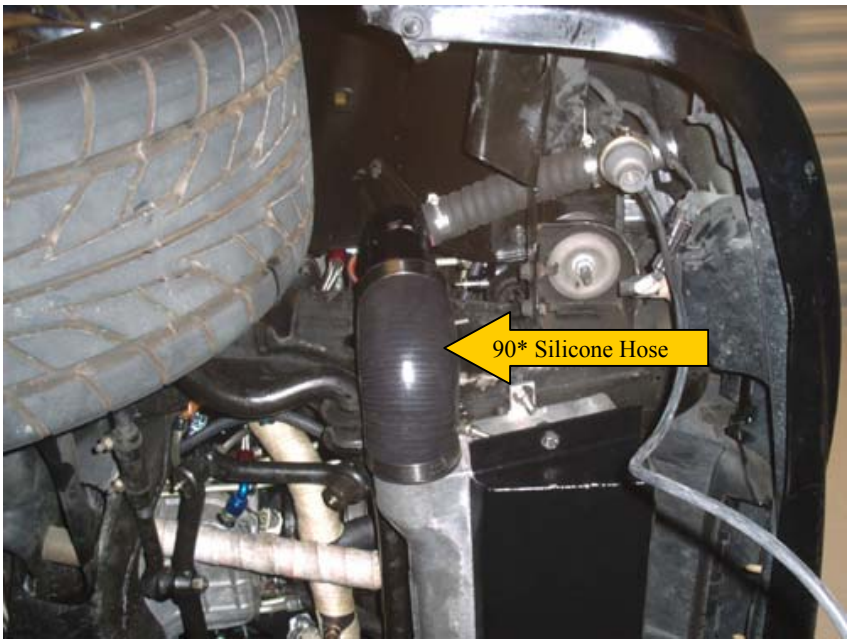
The intercooler is mounted horizontally and is located between the frame rails, sway bar and front air dam. Using the intercooler tank and sway bar as reference, they should be parallel. The mounting tabs on the intercooler are to be used to mount the intercooler to the vehicle's frame rails using the supplied 3/8-16 x 1-1/4" bolts with .5 aluminum spacers. Two holes must be drilled through the frame rails to place the bolts and mount the intercooler, (using the intercooler tabs as a guide for placement). Use a .406" drill bit. Please refer to the following pictures. Mount the intercooler scoop to the extra tabs on the intercooler using the supplied 3/8"-16 x 1" SS bolts, washers and lock nuts.

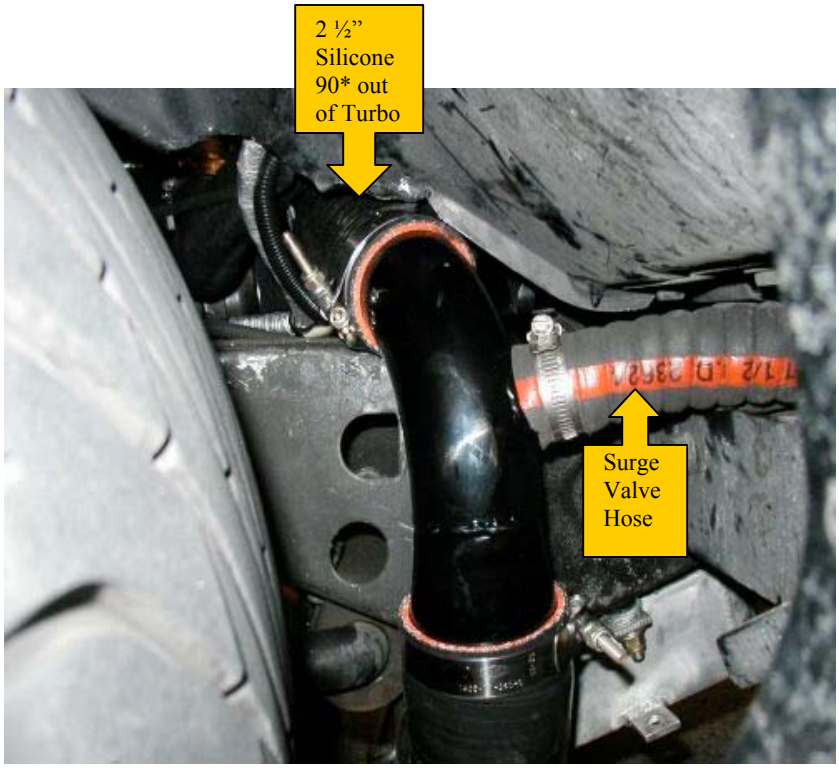




Intercooler Tube Routing Passenger's Side

The passenger's side intercooler tubes and hoses run as follows: Out of the intercooler attach 3" 90* silicone hose up to 2 ½"-3" steel 90* with surge bung to the 2 ½" silicone 90* up to the outlet of the turbo. Attach and secure all appropriate sized T-bolt clamps. All intercooler tubes are bead rolled to help prevent hose slippage while under boost.





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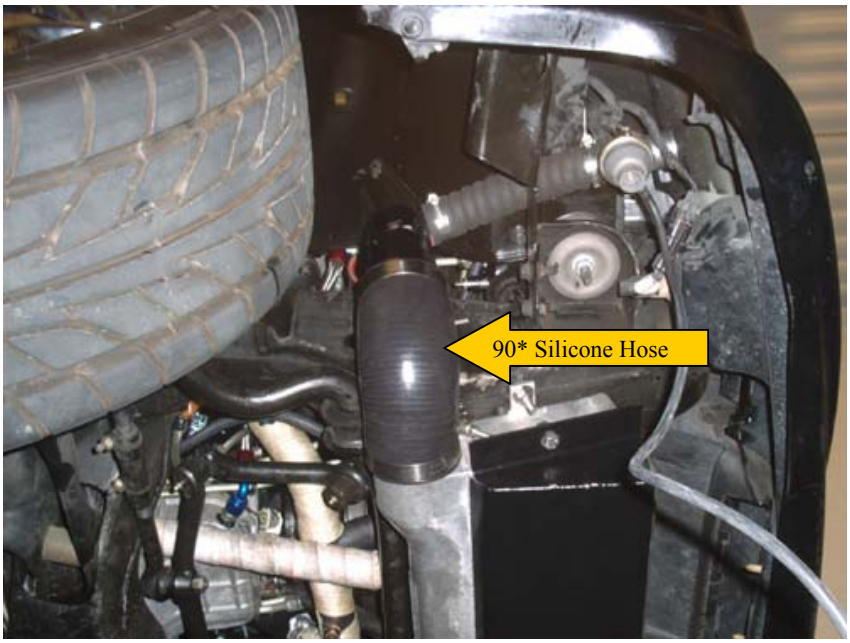
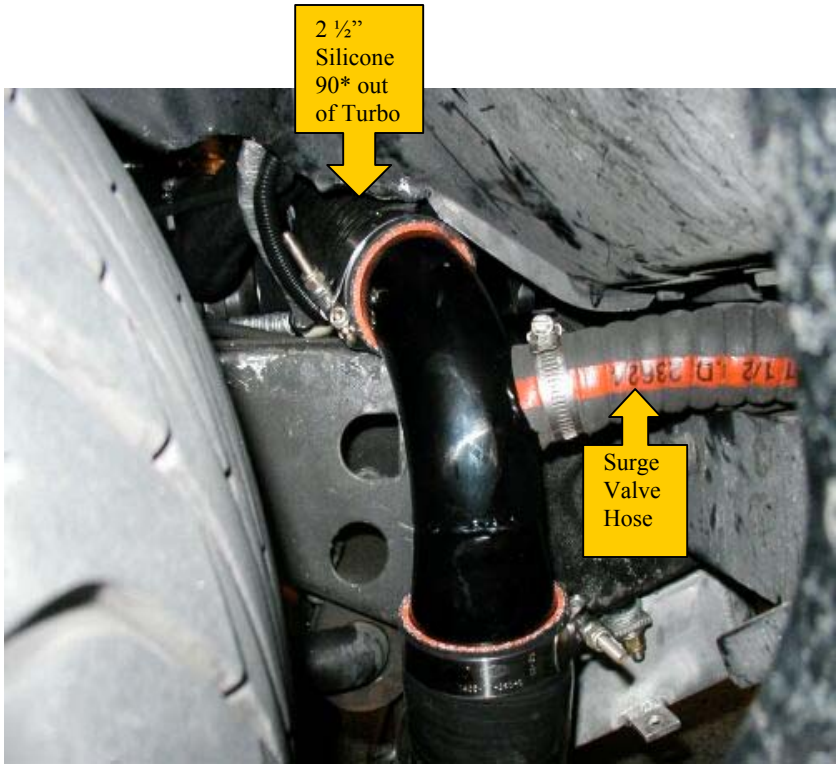
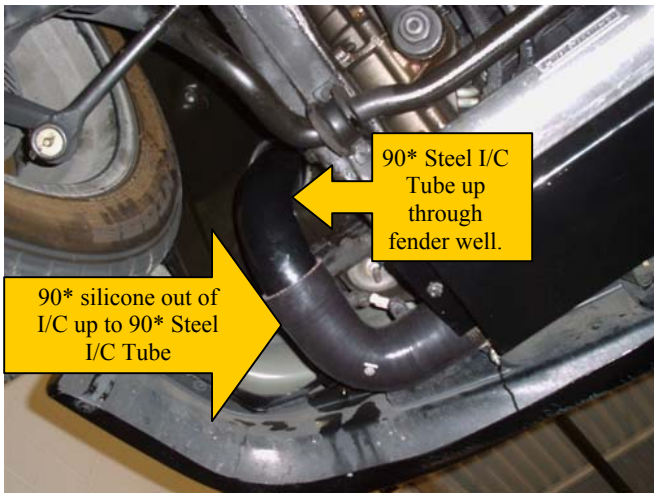


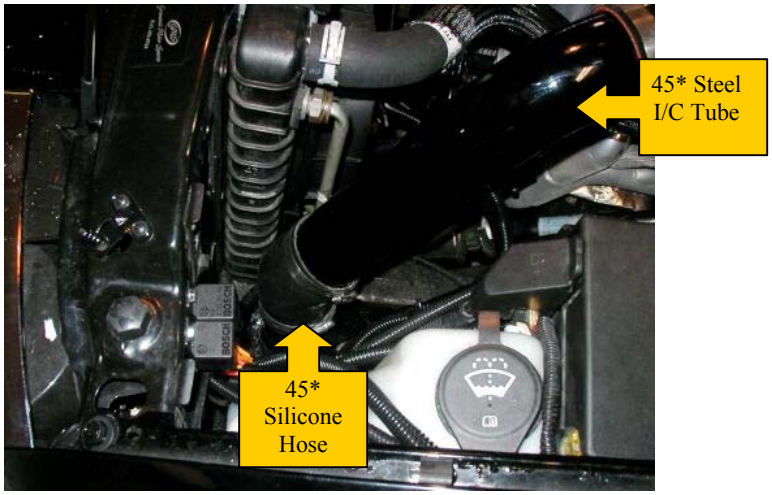


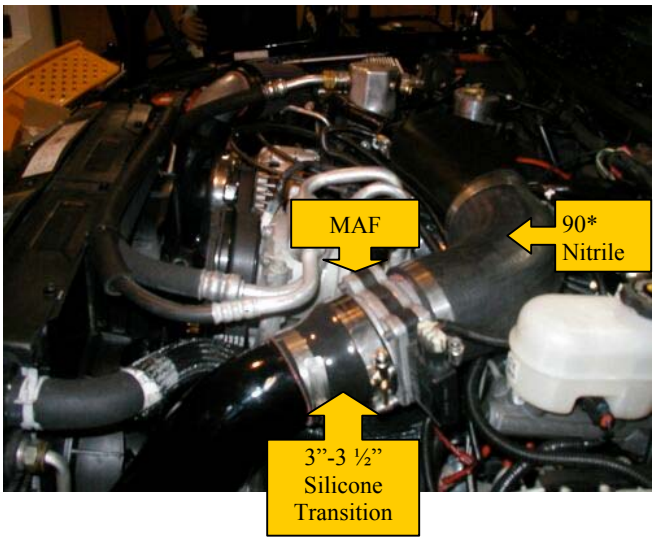
Intercooler Tube Routing Driver's Side

The driver's side intercooler tubes and hoses run as follows: Out of the intercooler attach 90 degree silicone hose and position it so that it faces upward. Next mark and notch a hole in the fender well so that the 90 degree steel tube with long leg may be installed to mate with the 90* silicone. We recommend using a drill and a 3 ¼" to 3 ½" hole saw to make a clean cut. (Tip: Vacuum line with a line split down the middle works well around the cut hole to protect the powdercoat from being scratched by the metal.) Next attach a 45 degree silicone up to the double 45 steel tube. At this point attach the 3"-3 ½" silicone transition, then to the Mass Airflow Sensor, to the Nitrile 3 ½" to the throttle body bonnet. Use supplied T-Bolt Clamps where appropriate and tighten securely.

***NOTE: THERE ARE DIFFERENT SIZE CLAMPS FOR DIFFERENT SIZE HOSES.**







Installation of Surge Valve

Install surge valve onto intercooler tube with bung on passenger's side. Use supplied 1 ½" hose and attach surge valve securely with hose clamps. The Surge Valve will blow off into the atmosphere. Attach supplied vacuum line from nipple on surge valve to a vacuum source in engine bay.

Installation Review & Safety Check

Carefully review the entire installation. Examine all intercooler tubes and connections. Make sure the steel tube is inserted properly into the silicone hoses and all hose clamps are tightened securely. Take precautions that all fuel lines routed near moving parts and exhaust components are protected from chafing or abrasion and are secure and free of twists and kinks. The air filter should also be installed to make sure there is no damage to the turbo's internals.

Note: Check and correct all fluid levels including oil, radiator, transmission and power steering.

After the inspection, start the engine and idle for a few minutes. Inspect connections for air or fluid leaks.

Shut off engine and check for fluid leaks, signs of rubbing parts and other potential problems.

Your vehicle should display a significant, detonation free increase in performance when you step on the throttle, yet maintain its previous drivability during daily driving.

For best performance and reliability, always use premium grade fuel (91 octane or higher). Always listen for signs of detonation after refueling, and after replacement or modification of any fuel system components. Back off throttle should detonation occur. With a properly installed intercooled turbo system, detonation should not be an issue.

NOTES: Larger cities, (especially in winter months), often use oxygenated or reformulated fuels to reduce pollution. Although these fuels have the same octane ratings as unaltered fuels, some people have experienced problems, (detonation), with their use. If you experience similar problems, it is advised to use octane booster to avoid detonation.

Be sure you have purchased and properly installed a fuel pressure gauge and/or air/fuel ratio meter to monitor fuel delivery while driving. Installation of a boost pressure gauge is also recommended.

Please review the owner's manual to be sure every step has been followed.

Tuning of an Intercooled Forced Induction Kit

Proper tuning and proper fuel pressure of a forced induction kit is very important. Setting the fuel pressure is one of the most crucial steps in starting the tuning of your kit. The fuel pressure should increase linearly from the stock setting, (58-62psi), depending on the vehicle, to approximately (80-95psi) at moderate to full boost conditions. Each vehicle, depending on their modifications and boost level, will experience a slightly different level of fuel pressure. To change the base fuel pressure, turn the center-adjusting nut counterclockwise to lean the mixture, (less psi). Turn clockwise to richen the mixture, (more psi).

Note: To check the stock fuel pressure, with the engine off, turn the key to the on position and read fuel pressure gauge. This will be your base fuel pressure setting.

If the vehicle hesitates upon snap acceleration or heavy black smoke is emitted from the tail pipe; lower your fuel pressure by turning the needle valve of the FMU counter-clockwise in ¼ turn increments until the hesitation is gone and the heavy black smoke is gone. This is just a baseline to get the system running safely.

Warning: The FMU air-bleed needle-valve adjustment is extremely sensitive. Reduce ONLY by ¼ turn increments at a time.

Too much fuel will cause the vehicle to hesitate, run sluggish, emit heavy black smoke out the tailpipe and not attain proper boost levels. A lean condition will cause detonation, (which under high boost conditions, can cause severe engine damage, run hot or break up).

We recommend running your system a little on the rich side until it can be tuned more accurately. We highly recommend the use of a "WIDE BAND" air/fuel ratio meter to get the most optimum results out of your new system. Meters that use stock oxygen sensors are excellent for tuning under idle and cruise conditions, but lack the necessary resolution in the area where the greatest power is made. These Wide Band Air Fuel Ratio Meters can read lower than the stock sensors. The proper air/fuel ratio should be approximately 12.0: 1 a/f ratio throughout the entire operating range.

Note: If you do not have the means to properly tune your new system, we recommend taking your vehicle to an experienced shop for proper tuning. Proper tuning is an important step of your install to assure safety to your engine and your investment.

Off-road, high boost applications require high-energy ignition systems for proper combustion. When using a stock ignition system, the spark plug gap should be set to .035". This will help avoid "blowing out the flame/spark."