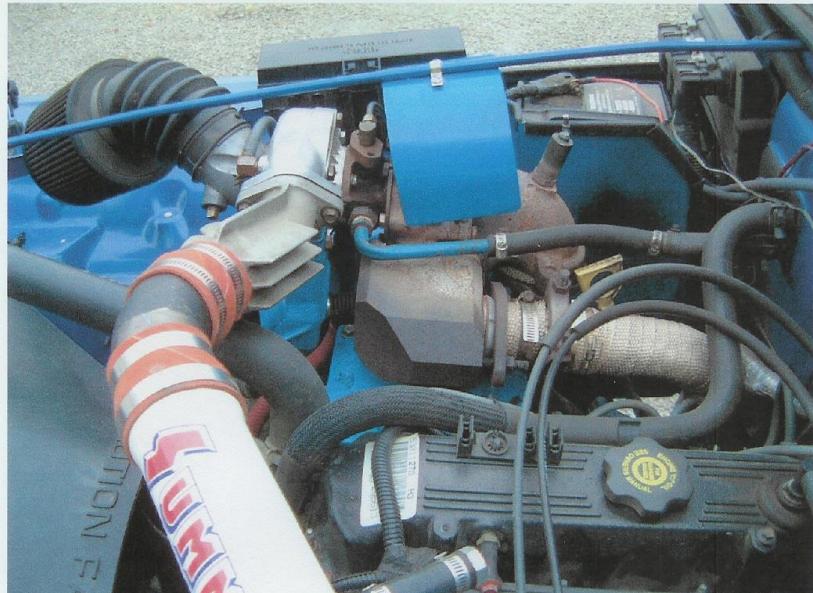


Jeep Wrangler TJ (1997-2002) 2.5L
w/o air conditioning
Turbo Charging Instructions



Section I

- Introduction
- Purchased Parts
- Fabricated Parts
- Turbo Installation
- Vendor Listing

Section II

- Intercooler, Electric Fan, BOV
- Fuel System
- Clutch

Section III

- The Sleeper

Introduction:

Congratulations on deciding to turbocharge your Jeep! By following the steps outlined in this manual, you will have a unique sounding, very powerful, little 4 cylinder Jeep. I completed my turbocharger installation in June 2001. I drive my jeep to work daily, so above all, it has to be reliable. To date, I have put over 17,000 miles on it with no problems. The following is a picture of my jeep.



1999 Wrangler SE 5spd. 2 1/2" Lift

I have added accessories that increased weight, as well as running 32" Super Swamper tires. In some cases 5th gear was no longer usable due to a lack of power to pull it. Now it will cruise effortlessly down the freeway at 75mph with the pedal depressed only about 1-2" in 5th gear. A quick down shift to pass and you'll be over 90mph before you know it. I have also seen about a 1-2 mpg increase in my fuel economy.

If you are like me, and need your Jeep to get to and from work on a daily basis, you cannot afford to have it torn down for several weeks and be without a vehicle. If you prepare all the components before the actual installation, you can easily install and plumb the turbo in a day. So, make all the parts you will need and purchase everything you will need ahead of time. Then go to town on the weekend installing it.

Note: These instructions are for Jeeps without air conditioning, because the turbo is mounted where the A/C compressor would normally be mounted. If your Jeep has air conditioning, it just means you'll have to find an alternate place to mount your turbo and the bracket described here in may not suit your needs. I also have a 1" body lift which aided in under hood clearances

Specifications:

- Garrett T3 Turbo Charger off of mid to late 80's Ford 2.3L
- 36 lb/hr Accel injectors
- 7 psi boost (higher if intercooled & modified fuel system)
- 92-93 octane pump gas (premium)

Turbocharger vs Supercharger

I researched for about 6 months prior to the start of this project. I had considered a small supercharger instead of a turbocharger. But in the end a Turbo just made more sense. Here are the reasons why.

Cost:

Turbochargers are plentiful and cheap compared to a supercharger.

If you change your oil regularly, they'll last the lifetime of your engine.

Power Loss:

The parasitic loss associated with a supercharger is between 10-15%. That means 10-15% of your horsepower is used just to turn the blower. Fact: On John Force's top fuel funny car it takes 400 hp just to turn the blower! With a turbocharger you only see about a 5% parasitic loss, so more of the horsepower produced actually makes it to the rear wheels.

Plus, a turbocharger does not stress the motor more than when it was stock; except for when you're in boost. If you drive around normally it's just as it was stock. Only when you put your foot into it and boost comes up are you asking more out of your engine.

I have laid out this manual into 3 sections. Section 1 deals with items you will need to purchase, items you will need to fabricate, and installation instructions. We will start with the purchased items first.

Purchased Parts (for basic turbo setup):

The following list covers most of the major items you will need to purchase, where you can get them and what you should expect to pay.

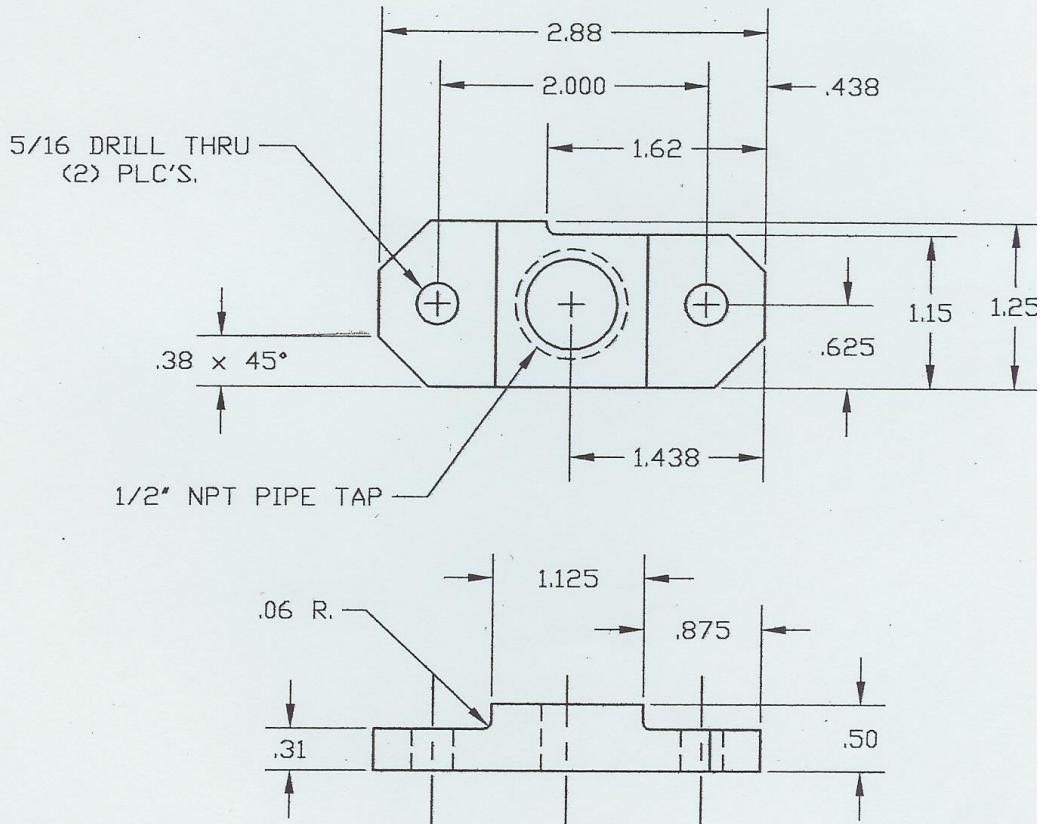
Item	Source	Part #	Qty	Cost
Garrett T3 Turbo Off Ford 2.3L mid to late 80's	Junk yard, E-bay, etc Turbo City -----	----- #100-630	1	Varies 455.37
Accel 36 lb/hr Injectors	Summit Racing	#150136	4	54.95/ea
Adjustable Map Sensor	Turbo City	#635-425	1	95.00
High Flow Air Tube	Turbo City	#560-102	1	83.95
Dial-A-Boost Knob	Turbo City	#750-100	1	43.95
Silicone Hose Couplers	Turbo City		2	12.50/ea
Header Wrap	Summit Racing	#THE-11001	1	23.95
Boost / Vacuum Gage	Summit Racing	#ATM-3303	1	42.95
2" Exhaust Donut Gasket	Napa Auto Parts	#F7269	1	12.00
Air/Fuel Ratio Gage	Summit Racing	#ATM-3375	1	51.95
Gage Pod	Tri-County Gear	#TCG-02TJ	1	34.95
2" Dia. X 6' Long Flex Pipe	Local Auto Part Store		1	8.99
2 1/4" Dia. X 6' Flex Pipe	Local Auto Part Store		1	8.99
5/8" O.D. copper tubing – 3' & brass fittings	Local Hardware Store			6.00
1/4" O.D. copper tubing – 3' & brass fittings	Local Hardware Store			4.00
High Flow Air Filter	Turbo City	#550-458	1	49.95
Turbo Mounting Gasket	Ford Dealership	#E3ZZ-9450-A	1	16.00
Oil Plate Gasket	Ford Dealership	#E3ZZ-9440-A	1	8.00

Note: If you can find a cheap car to buy and pirate your turbo from, you can get not only the turbo, but all the lines and hoses connected to it. Then resell the car or part it out. I bought a 1985 Merkur XR4Ti with a bad transmission for \$350.00. After removing the turbocharger and hoses, I re-listed the car and sold it for \$220.00. Therefore, I got my turbocharger and all the lines and hoses connecting to it for \$130.00

Fabricated Parts:

The following drawings illustrate the parts you will need to fabricate prior to installing your turbocharger.

NOTE: THIS PART TO BE USED
WITH A NEW GASKET
FORD PART #E3ZZ-9440-A

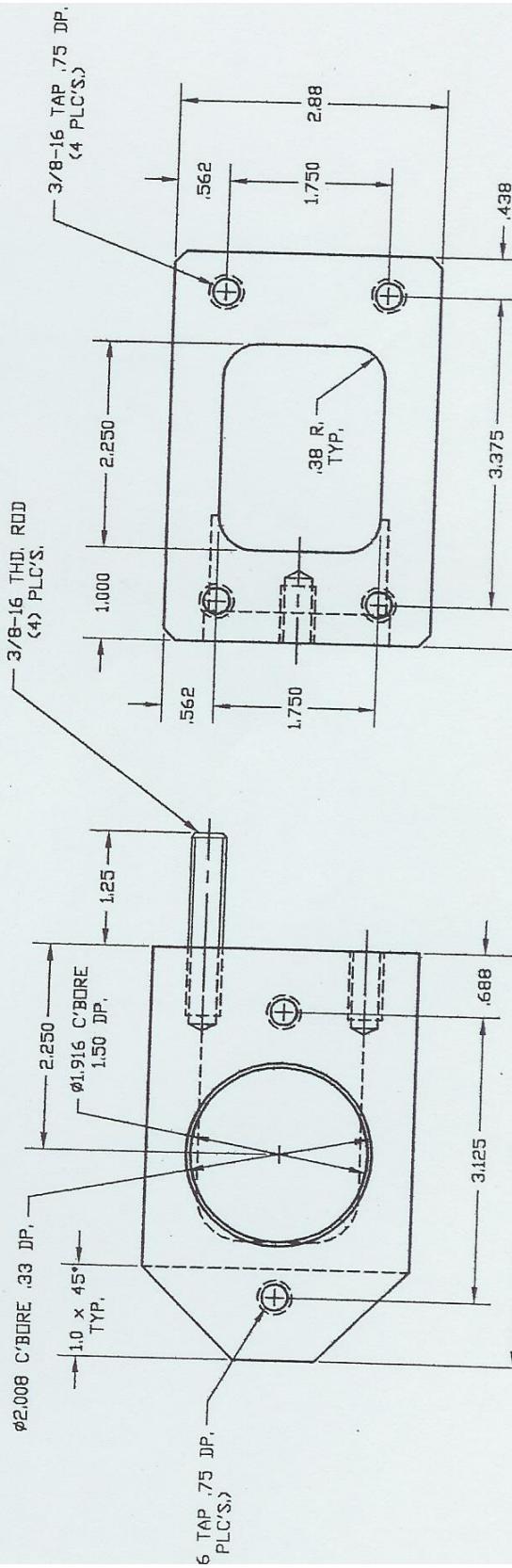
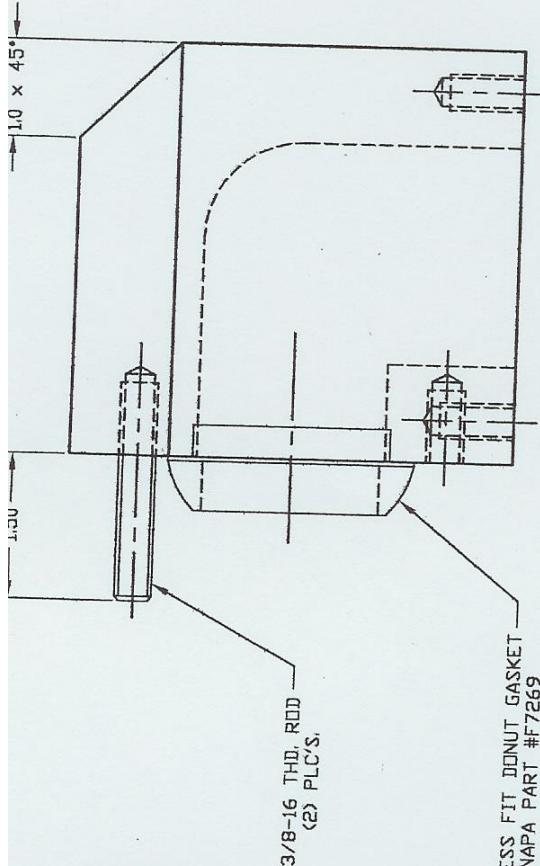


NOTE: THREAD A LENGTH OF 3/8-16 RD
INTO THE 6 TAPPED HOLES AS SHOWN

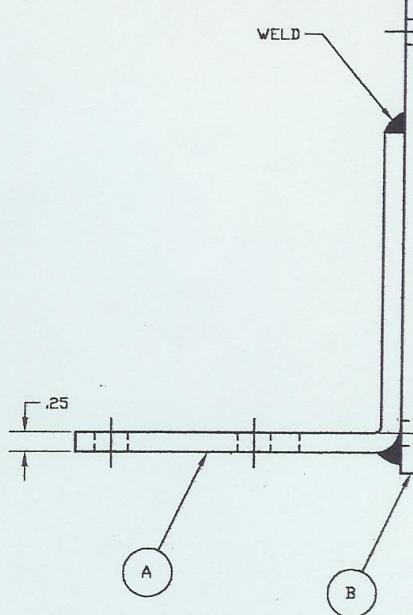
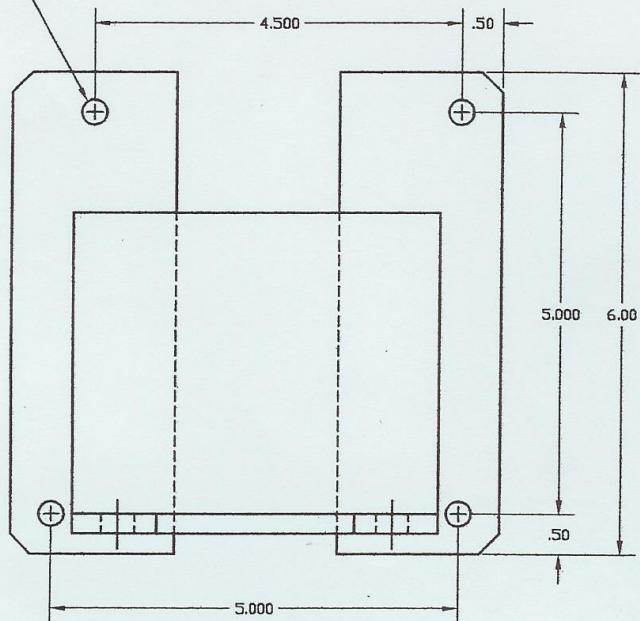
THIS PART TO BE USED WITH A NEW
GASKET, FORD PART #E3ZZ-9450-A

ADAPTER BLOCK
MATERIAL - C.R.S.

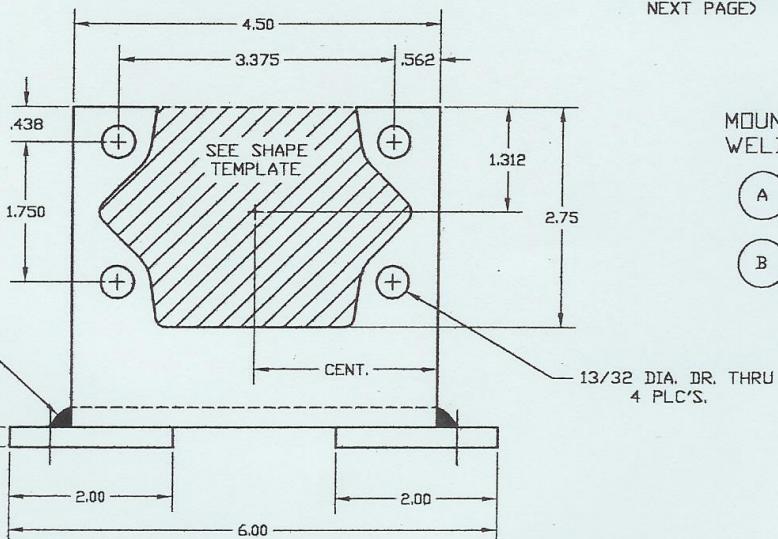
PRESS FIT DONUT GASKET
NAPA PART #F7269



5/16 DIA. DR. THRU
4 PLC'S.



(SEE SHAPE TEMPLATE
NEXT PAGE)

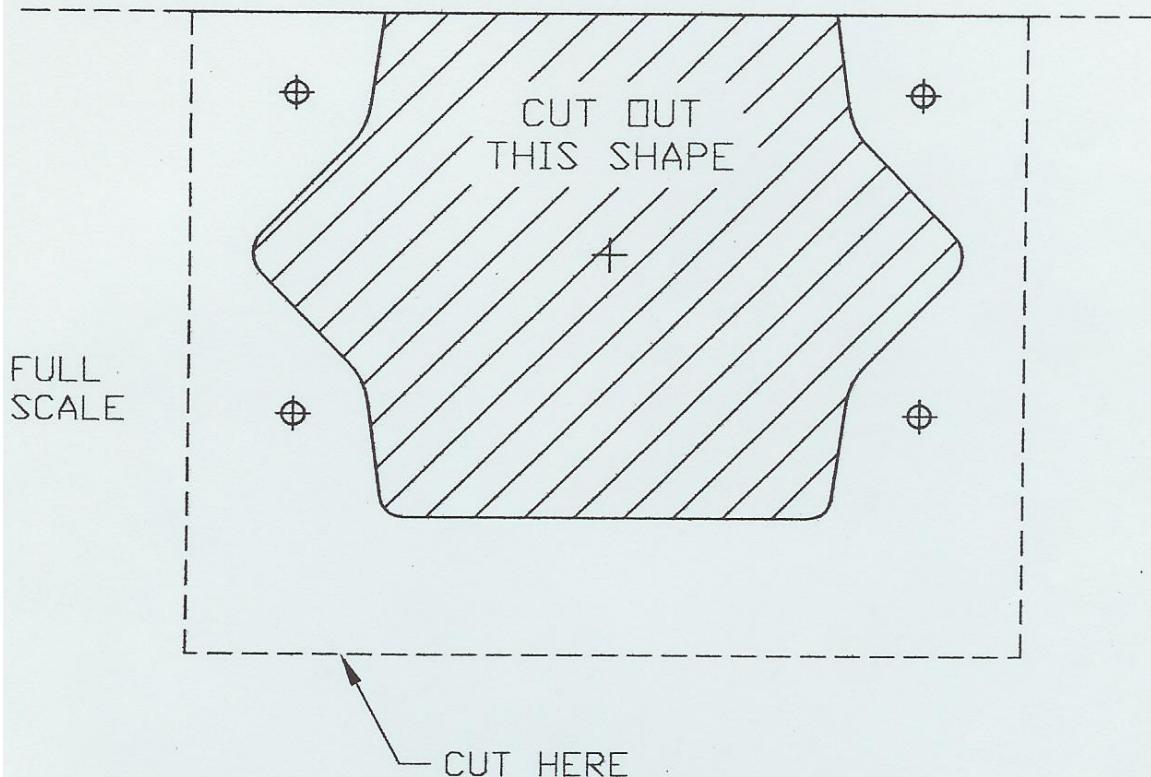


MOUNTING BRACKET
WELDMENT

(A) 4" x 4" ANGLE IRON x 4 1/2" L
1 REQ'D.

(B) 2" x 6" x 1/4" THK.
2 REQ'D. - C.R.S.

CUT OUT THIS TEMPLATE AND USE IT AS A PATTERN TO MARK YOUR HOLE LOCATIONS AND TO OUTLINE THE SHAPE OF THE CUTOUT YOU WILL NEED TO MAKE IN PART "A" OF YOUR MOUNTING BRACKET.



NOTE: FABRICATE A HEAT SHIELD OUT OF SHEET METAL TO COVER THE REAR OF THE TURBOCHARGER, BEND A 4" WIDE PIECE IN AN ARC AROUND THE TURBO HOUSING LEAVING A 1 - 2" AIR GAP BETWEEN THE TURBO AND THE HEAT SHIELD, THIS WILL PROTECT THE HOOD FROM THE RADIENT HEAT PUT OFF BY THE TURBOCHARGER.

ATTACH TO GRILL SUPPORT ROD
JUST ABOVE TURBO
(SEE FRONT COVER)



First Things First:

Install air/fuel ratio gage and boost/vacuum gage into gage pod (Tri-County Gear) or other suitable mounting plate and wire up per instructions. These gages are an invaluable tool in calibrating everything and insuring you do not blow up your motor the first time out. The turbo has the potential to supply a destructive amount of boost to your engine. As boost increases ("air in"), fuel must increase as well. If you push more air into your engine and don't adjust fuel accordingly, it will run too lean. The leaner it runs, the hotter the combustion chamber gets. It only takes a few seconds at an extreme lean condition to melt a hole through your stock cast pistons, then its "rebuild time". This is definitely a case where an ounce of prevention is worth a pound of cure!

As long as the air/fuel ratio is set up right and boost is regulated properly, your 4 cylinder can make a load of safe non-destructive horsepower. If these adjustments are ignored, you will most definitely not get to enjoy the fruits of your labor. I would suggest installing the gages weeks ahead of the turbo. This will give you the opportunity to monitor the air/fuel ratio gage and observe its readings during various driving conditions. These readings should be the same after the turbo is installed. Under full throttle the air/fuel gage should be into the "rich" area. After the turbo is hooked up, full throttle readings should remain in the "rich" area. If not, you'll need to richen up the setting on the adjustable map sensor or back down the boost. Through careful driving and adjusting you will discover the best settings for power and efficiency. For myself, 7 psi of boost for an estimated 180-190 hp worked well. By adding an intercooler, modifying the fuel system further, and getting a set of forged pistons, you can run 12-14 psi of boost and get 250+ hp without any trouble.

Turbo Installation:

Remove the entire air filter box and the tubes running over to the throttle body. You will be mounting the turbocharger where the air conditioning compressor would have been. Bolt the turbo to the mounting plate and adaptor block. Be sure to use a new gasket, Ford part #E3ZZ-9450-A. Then bolt the mounting plate to the air conditioning bracket.

Now you're ready to start plumbing up the turbocharger. Disconnect the oil sending unit from the left side of the block just in front of the distributor. Screw in a "T"-fitting and then re-connect the oil sending unit to the "T"-fitting. Use the other outlet from the "T"-fitting to run a $\frac{1}{4}$ " copper oil line up to the turbo. (See fig. 1-1) Now you have oil supplied to the turbocharger.



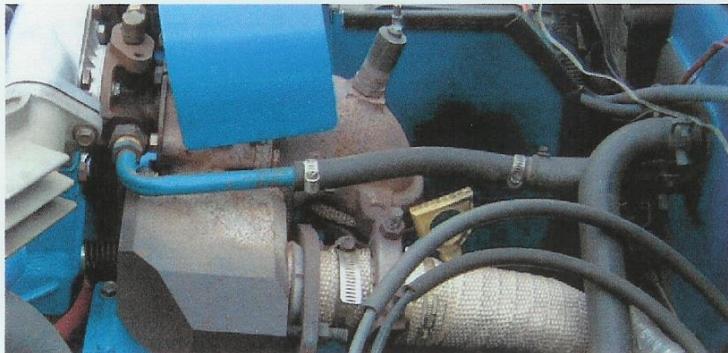
(Fig. 1-1)



(Fig. 1-3)

Next comes the oil drain line. Attach a 6-7" length of $\frac{1}{2}$ " I.D. copper tubing to the oil drain plate you made. Make the connection using a brass pipe fitting, a farrel, and a nut. (See fig. 1-2) Then, bolt it to the turbocharger. Be sure to use a new gasket, Ford part #E3ZZ-9440-A. Next, remove the oil pan and drill a $\frac{3}{4}$ " dia. hole through the pan on the passenger side. Make sure the hole is above the oil level line. If the oil level in the pan covers this hole, oil can back-up and blow the seals in your turbo. Braze in a $\frac{5}{8}$ " dia. brass fitting. (See fig. 1-3) Bolt the oil pan back onto the motor. Then attach a length of the same size tubing to the oil pan fitting you installed, bending it up toward the turbocharger. Connect the two $\frac{1}{2}$ " copper lines with a piece of $\frac{5}{8}$ " heater hose and hose clamps.

Now we'll connect the water lines. Since all we need is a supply of coolant passing through the turbocharger, I used the heater core return line to accomplish this. Reroute the lower hose coming out of the heater core over & into the water "In" port on the turbocharger. (See *fig. 1-4*) Run a line from the water "Out" port of the turbo to the return line on the water pump, where the heater core hose would have connected. You will need to get some small adapters from your local hardware store because the heater core hose is $\frac{1}{2}$ " and the turbo line is only $\frac{3}{8}$ ". You will need to "neck it" down before it goes into the turbo, and then back up again before the water pump.



(Fig. 1-4)



(Fig. 1-2)

Exhaust:

Obtain a 2" dia. piece of exhaust pipe 4-5" long, flared on one end, and the appropriate flange clamp at a muffler shop for use on the turbo adapter block. (See *fig. 1-5*) Obtain a $2\frac{1}{4}$ " O.D. piece of exhaust pipe 4-5" long flared on one end and the appropriate clamp flange for use on the turbo exhaust outlet. These 2 short pieces of pipe are only for temporary use. These pieces will provide attachment points for the flex pipe temporary exhaust. If you tow your Jeep to a muffler shop to have hard pipe bent up, you will not need these pipes or any flex pipe! I would recommend hooking up the temporary exhaust, if for no other reason than to be able to start up your jeep and get it dialed in and running decent before someone else at a muffler shop tries to start it and drive it up on a lift.



(Fig. 1-5)

If you can cut the down pipe without removing it, you will save a lot of time. Cut the down pipe coming out of the exhaust manifold about 4" below where the 02 (oxygen) sensor attaches. Then cut it about 4" in front of where the hanger bracket attaches at the front of the catalytic converter, leaving the bracket attached. Run a piece of 2" flex pipe from the down pipe coming off the exhaust manifold, under the oil pan and up to the turbocharger. Attach it to the small length of 2" pipe that is flared and clamped to the adapter block. Secure at both ends with an exhaust clamp. Then run a piece of 2 1/4" flex pipe from the exhaust outlet tube, that is on the turbo, down to your exhaust pipe coming out of the front of the catalytic converter. Secure at both ends with exhaust clamps. This flex pipe is only to be used to drive the vehicle for a few days until you get it to a muffler shop and have hard pipes bent up. It will not last much longer than that, especially the piece between the exhaust manifold and the turbocharger. This section of pipe sees a lot of heat and pressure. After your hard pipes are bent up and installed, use the header wrap to cover the pipe from the exhaust manifold to the turbo. You only need to wrap the section of pipe coming up the side of the engine block to the turbo. This will greatly reduce the amount of heat under your hood and keep things that get to close to this pipe from melting.

Note: Make sure the muffler shop does not bend the pipe and route it in a manner that prohibits you from removing your oil filter! You may also want to relocate the coil to the firewall. It will be subjected to a lot less heat there.

Injector Installation:

Remove the bolts holding down the fuel rail. Remove the retaining clips that hold the injectors to the fuel rail. Carefully lift the fuel rail off of the 4 injectors. Remove the 4 stock fuel injectors and replace them with the new Accel units. Carefully push the fuel rail back down onto the 4 new fuel injectors, making sure to seat all the o-ring seals. Reattach the 4 retaining clips and retighten the bolts holding down the fuel rail. Install the adjustable MAP sensor per the instructions supplied with it.

Note: Allow the vehicle to sit overnight before attempting to remove the fuel rail.

The fuel system maintains 48psi when running and it takes some time for the pressure to neutralize after it is shut off.



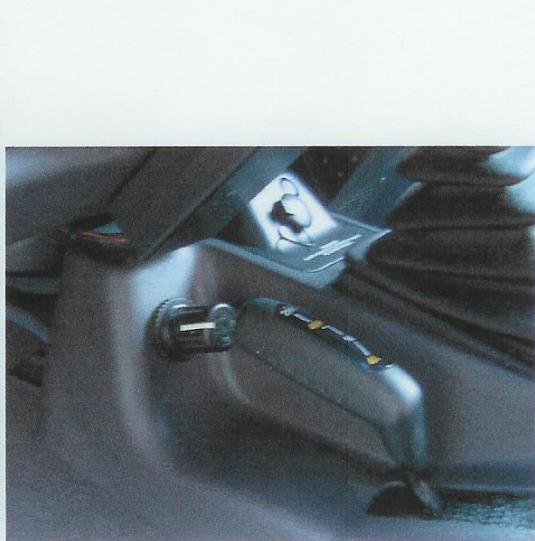
(Fig. 1-6)

Intake Tubing:

Install the Turbo City air tube. Cut a piece of 2 1/2 " mandrel bent pipe to fit between the air tube and the turbo outlet housing. Connect at each end with 2 1/2" silicone turbo coupler hose and hose clamps. (See fig. 1-6) Plug the hole in the air tube from Turbo City that was to be connected with a hose to the valve cover vent. If this is left attached you will pressurize the top of the motor under boost. Attach a long length of hose to the valve cover vent port and run it over to the fender and down under the Jeep. Cut off the corrugated end of the stock air tube and attach it to the front of the turbo charger. Attach the new high flow air filter from Turbo City to the other end of the corrugated piece. This will angle your air filter in a manner that allows the hood to close. (See fig. 1-7) Install Dial-A-Boost knob per instructions supplied with it. I found the console area just in front of the 4WD lever to be a good location for this knob. (See fig. 1-8)



(Fig. 1-7)



(Fig. 1-8)

Tuning Tips:

The Dial-A-Boost knob is your adjustment for the amount of boost the turbo supplies to the engine. Rotate counter-clockwise for less boost, clockwise for more. The adjustable MAP sensor is your adjustment for fuel quantity. Rotate clockwise for less fuel (leaner), counter-clockwise for more fuel (richer).

That's all there is to it for the basic turbo setup. With 7 psi of boost you should have comparable power with a stock 4.0L six. If you would like to add further enhancements see Section II.

The following are contacts you will need to obtain some of your parts:

Turbo City: (1-714-639-4933)

web: www.turbocity.com

Summit Racing: (1-800-230-3030)

web: www.Summitracing.com

Tri-County Gear: (1-909-623-3373)

web: www.TriCountygear.com

Granatelli Motorsports: (1-805-486-6644)

web: www.Granatellimotorsports.com

Vortech Engineering: (1-805-247-0226)

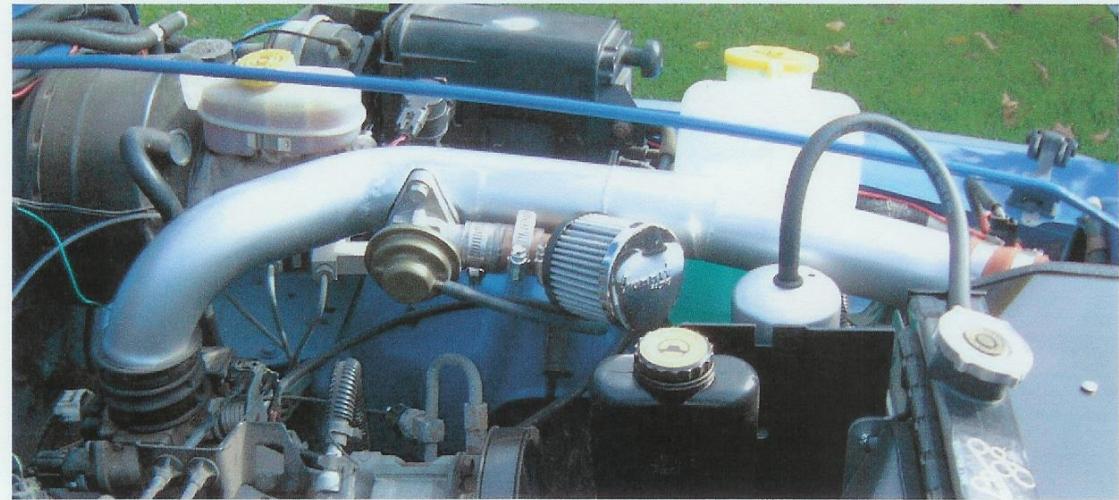
web: www.Vortechsuperchargers.com

Note: I have attempted to make this manual as complete as possible, however I'm sure many of you will still have questions about certain things. I can be reached at TurbochargedTJ@aol.com for any technical questions you may have. I will try to get back to you promptly. I will, however, only respond to questions from the manual, to those of you that have purchased one.

Section II



This is a picture of the engine bay after completing the installation of the intercooler, electric fan, and the blow off valve. The intercooler is a Volvo unit part #1317319. It is perfectly sized to fit in the Wrangler, and will mount in front of the radiator. (the ideal location) The electric fan is a Flex-a-lite unit from Summit Racing part #FLX-475. The k make the v



A blow off valve (BOV) serves to vent pressure from the intake system when the throttle body butterfly is closed. Such is the case when you are shifting gears in a manual transmission, or decelerating. This is desirable because, if not vented, the pressure will build up and act as a brake on the spinning turbo, in effect, stalling it. When you accelerate again you will be waiting on the turbo to spool back up. Without a BOV, you will notice more “turbo lag”.

An intercooler cools the incoming pressurized air. This is desirable because the colder air is, the denser it becomes. Two identical engines, both running 7 psi of boost, will make different amounts of power if one is intercooled and one is not. The intercooled engine, because of having colder, denser air going into it, will require more fuel to compensate for the added amount of oxygen and therefore make more power. Another added benefit of colder air entering your engine is lower combustion chamber temperatures, thus reducing the risk of detonation.

Once these items are installed you will need to do two more things before you can crank up the boost and make some serious horsepower. The stock fuel system (fuel pump/regulator) will need to be upgraded to provide the fuel needed for more boost. I upgraded to a 255 liter/hr. high pressure, in tank, fuel pump from Granatelli Motorsports part # GM255-HP. This is a Walboro unit and cost \$160.00. I also upgraded the fuel pressure regulator with a Vortech Super FMU (fuel management unit). This retails, through Vortech, for about \$300.00, but the adjustability of it is worth the cost. These 2 items are not direct bolt-ins and a considerable amount of modifications to the stock “fuel pump module” will need to be done. You will also need to run a separate “in line” fuel filter, as the stock fuel pressure regulator/fuel filter will no longer be in place. I also installed 44lb/hr. fuel injectors. The fuel system upgrades are not hard to do, they just require some time and patience. The second thing you must do is up-grade your pistons. The stock cast pistons will not take boost levels above 8psi. for any length of time. You will need to get a good set of forged pistons installed. Once completed your 2.5L will be capable of doubling the horsepower it had stock.

To get the most out of all of this horsepower, I would recommend upgrading the factory clutch if you have a manual transmission. Centerforce makes a good upgrade that has 90% more holding power than the stock clutch

I have not described, in detail, the installation procedures for the items described in this section. Most of you will probably be happy with 7 psi of boost. But if you would like to install one, or all of the Section II components, and have questions, please e-mail me and I will respond promptly. The items described in Section II, combined, will add another \$1,600 (aprox.) to the cost of your project.

This is a very worthwhile project to undertake. Once finished you will have a very unique Jeep. No matter where I go, when I lift my hood, it always draws a crowd.



Get Boost!

Section III

The following is a list of all the components that went into my “sleeper motor”. If you have any questions on where or how, to get this work done, or to purchase some of these parts, please drop me an email.

1999 2.5L Jeep Engine Specifications:



Here is a picture of the finished product.

With the larger injectors (44lb/hr), and the adjustability of the Roe Racing control unit, (VEC1) which has the ability to fine tune fuel and timing (see picture below)(www.roeracing.com), I have run up to 18psi of boost with no problems. The Vortech Super FMU has a 3.25:1 ratio disk in it. Static fuel pressure is set to 41psi. Fuel pressure at idle is 26psi. I am running my stock PCM (no reflashes). My fuel mileage is averaging 15-16mpg. (93 octane) If you're ever in the area (Toledo, OH), look me up. I'll be more than happy to take you for a ride.

