Installation of a 3X00 engine into a 1990-1994 General Motors J-Body vehicle

(Other years may be possible but I have not tried to set up the computer controlled ignition and fuel injection)

Revision 1.00

Standard Disclaimer

All procedures described in this document are intended for off highway use. This retrofit should only be attempted on a J-Body vehicle in excellent condition due to the extra stresses that this new engine will introduce to the vehicle. Following the procedures outlined in this document is done at your own risk. The General Motors J-Body vehicles were never mass produced with an engine as powerful as the newer 3400, and therefore this replacement may not be inherently safe. Stock brakes on most J-Body Vehicles are inadequate for the power and speed that this engine makes a J-Body vehicle capable of. This document is intended only as a guide. Retrofitting an engine is a complicated task where unexpected results can arise. This procedure should only be attempted be persons with a high level of mechanical skill.

Required Parts List

Engine

1999 and newer 3400 Engine offers the highest horsepower and best flowing cylinder heads.

Engines in the mini vans list with a higher horsepower but I have not been able to find a difference between the cars and vans.

The injectors on the 1999 engine are more similar to the original injectors than the 2000+ engine.

The EGR valve on the 1999 will involve fabrication of a plate. The EGR valve on the 2000+ will involve fabrication of a tube with flanges.

There is a mounting boss on the front passenger side of the oil pan that has to be ground off to allow the AC bracket and compressor to fit.

Boss before grinding

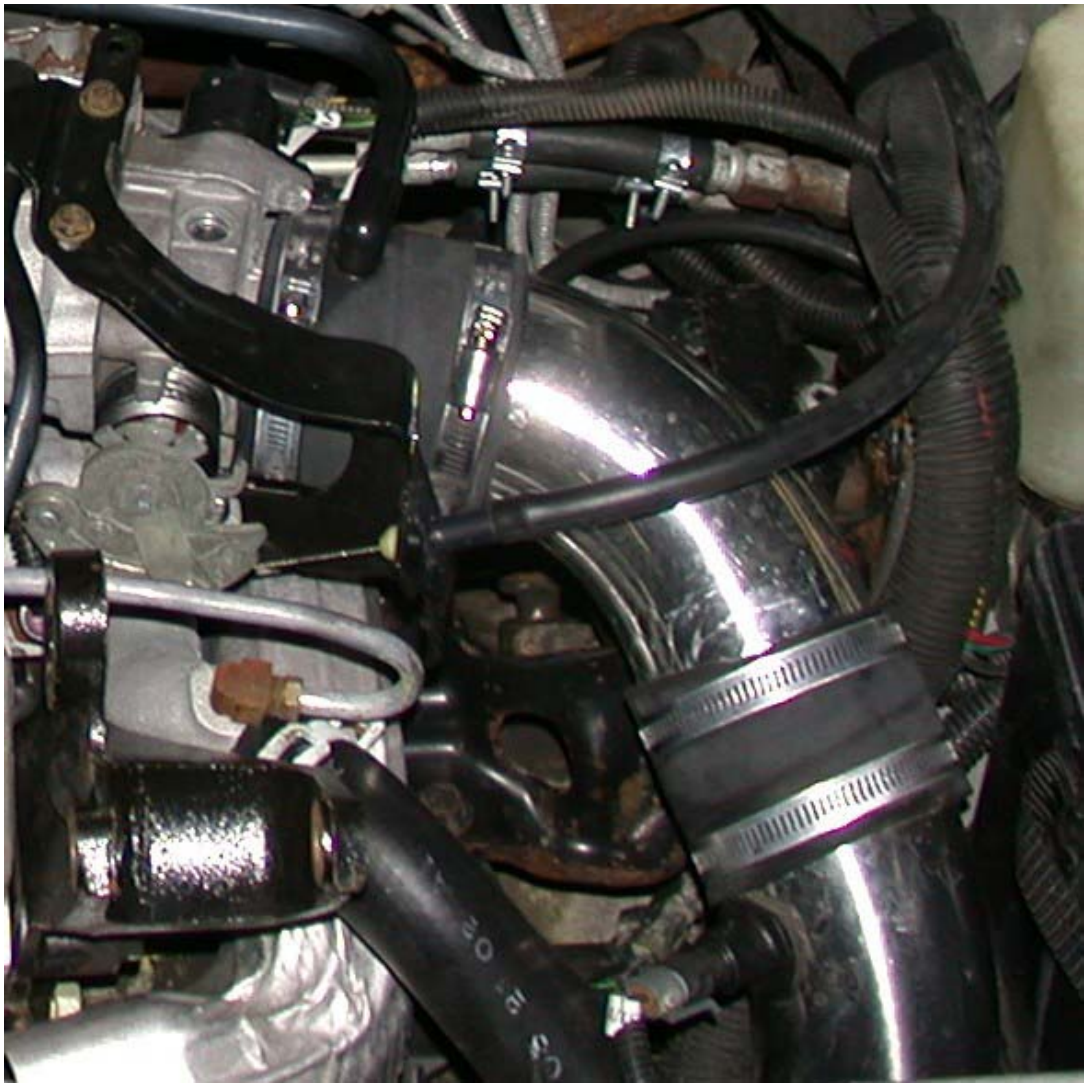
Boss after grinding

Clutch and Pressure Plate	I recommend a Bully Stage 2 clutch because of its greater than stock holding power and the nice drivable clutch pedal pressure and feel.
Flywheel	The 3.1's flywheel is fine to use.
Flywheel Inspection Cover	Use the 3.1's, but it must be ground off to fit around the 3X00's oil pan.
Rubber engine mounts	Any worn mounts should be replaced, ideally all mounts should be replaced with Urethane J-Body performance pieces.
Starter	Either Starter will work. The 3X00's is smaller and lighter in weight than the 3.1. One has worked fine on my vehicle for almost six (6) months.
Oil filter adapter	Use the Oil Filter adapter from the 3.1. You may have to grind off a tab on the adapter to fit with the custom engine mount bracket.

Alternator and brackets	Use the Alternator and bracket for a 3.1.
Power Steering Pump	The power steering pump from the 3X00 must be used
Power Steering Lines	The low pressure line is no problem. Low pressure power steering hose can be purchased from most parts suppliers. The high pressure line from the 3.1 can be used and bent to shape while the engine is out of the car. Be careful not to kink the high pressure line.

Please note the shape and position of the High and low pressure Power Steering lines. High pressure is away from the block holding the Low Pressure line in place.

Air Filter	A custom cold air intake can be fabricated using aluminum J-Bends. It is difficult to get the original Air Cleaner assembly to fit.



Custom cold air intake, please note the Intake air temperature sensor

Throttle Position Sensor	Use the 3X00's TPS
Idle Air Control Solenoid	Use the 3X00's IAC
Intake Air Temp. Sensor	Use the 3X00's IAT
Throttle Cable Bracket	Use a throttle cable mounting bracket from a 3X00 in a car, there are several that can fit, parts availability is your greatest consideration.
Throttle Cable	Use A throttle cable from a 3X00 equipped 1995 Grand Am, Alero, or Beretta or W-Body car, there are several that can fit, parts availability is your greatest consideration.

Fuel lines

You will need to buy the appropriate sized high pressure fuel injection fuel line and high pressure fuel injection line clamps. You should keep the run as short as possible and double clamping is advised.

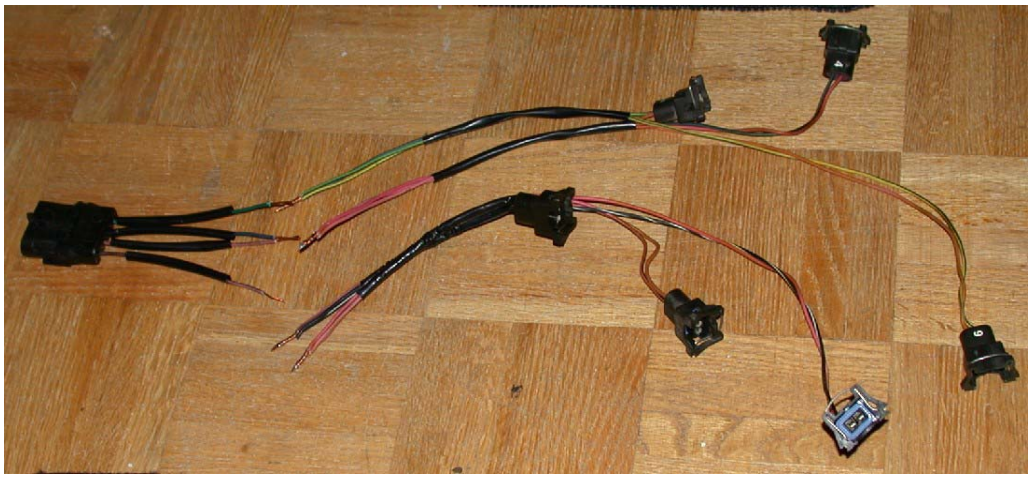
Double clamped fuel lines near Antilock Brake Master Cylinder

Fuel Injectors

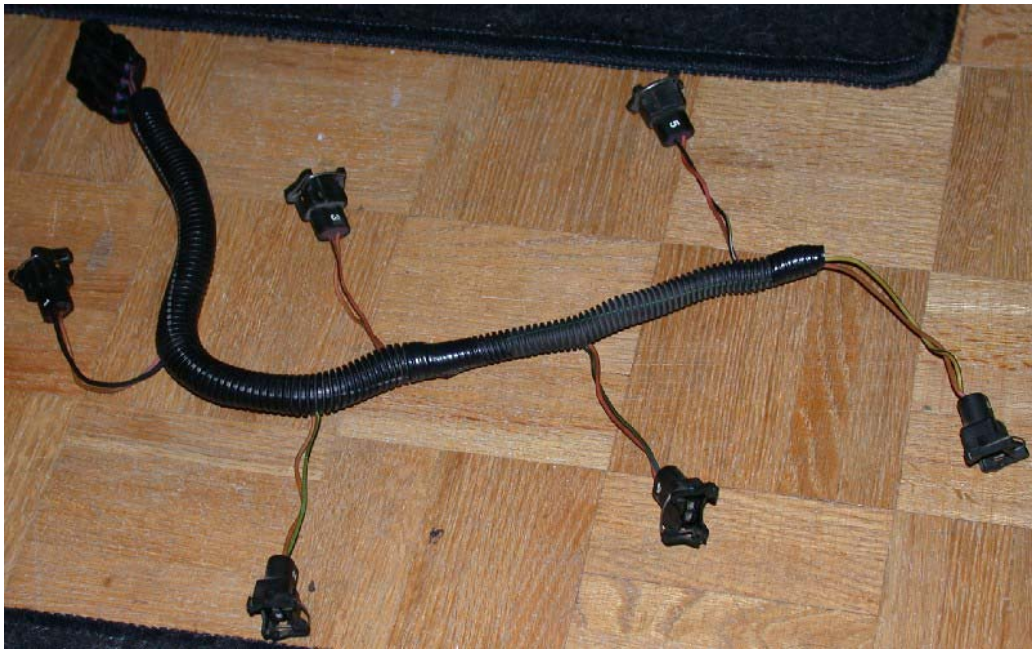
The 3X00's injectors flow a considerable amount more fuel and are said to be more precise than the 3.1 injectors. That means that if you use the 3X00's injectors, you must reprogram the computer. If you use the 3.1's injectors, you risk not being able to get enough fuel for the engine. I choose to use the 3X00's injectors. Others have used the 3.1 injectors when swapping only the top end of the engine to a 3X00 style, and had good results.

Injector wiring harness

You will need a soldering iron, solder and heat shrink tubing. The 3X00 has sequential fuel injection. The 3.1 has multiport. You will need to draw a diagram of your current 3.1 fuel injector wiring harness and you will have to rebuild it so that it is the same electronic circuit, but plugs into the injectors you choose to use and routes in the correct space under the 3X00's Upper intake manifold. Please note that on some years the coolant temperature sensor wiring is in the injector wiring harness.



Injector Harness laid out to be soldered



Injector Harness Completed

Upper Radiator Hose	Use a hose from a Grand Am, Alero, or Beretta. I used a 1995, others have used 1999 or newer. You will have to trim off both ends but the hose can be made to fit fine.
Lower Radiator Hose	The stock 3.1 hose uses three hoses with a T fitting in the middle. One hose to the radiator, one to the coolant reservoir and the third to the water pump housing. The water pump inlet pipe on the 3X00 is smaller than the inlet on the 3.1. To get around this problem, I purchased a new lower radiator hose assembly. I removed the hose that goes from the T to the water pump from the new hose. I removed the hose that goes from the T to the Radiator from the old hose. I installed the piece of the old hose onto the new hose assembly and that worked out fine.
Heater Hoses	The heater hoses involve creativity. If you have a newer J body, the heater lines come out from the engine to the heater core on the transaxle side of the engine. This is similar to the 3400's heater hose orientation. The pipes that come off the engine will have to be bent to clear the master cylinder and any other obstructions. You should also keep in mind that you do not want the hoses running physically higher than the coolant level in the coolant reservoir, if they do, you may end up with air trapped in the heater hoses and no heat. If you have an older J Body where one heater hose comes out on the transaxle side of the engine, and the other comes out by the water pump and goes around the engine, You will need to use creativity. The pipe fitting that comes out of the water pump housing can be rotated 90 degrees so that the pipe that would feed coolant to the throttle body heater and then the heater core, gets cut short, and feeds coolant to the pipe that runs under the upper intake manifold. Then the pipe that used to feed the pipe under the upper intake manifold is in the right spot to feed the heater line by the coolant reservoir. In order to rotate this pipe assembly, you tap the flange off with a hammer and a large socket and then rotate the flange, then tap the flange back in place. I used RTV (silicone sealant) around this fitting to ensure a good seal.
Vacuum Lines	Use ¼ inch steel brake line for larger vacuum lines and 3/16 inch steel brake line for smaller vacuum lines. Use proper vacuum hose where needed. Other types of hose can collapse under vacuum.

Power Brake Vacuum Hose	I used half from the 3X00(from the engine to the 3.1 hose) and half from the 3.1. (from the 3X00 hose to the brake booster
Coolant Temp Sensor/Sender	The 1999 Montana minivan had a three wire sender/sensor that works fine and the appropriate harness connecter can be bought from GM at the same time.

Three wire temp sensor with harness plugged in. The replacement harness has no color coded wires. The wiring on this connector corresponds with the color of wire on the 3.1 wiring harness. Green is the gauge temp sender wire. Black and Yellow are for the computer temp sensor portion.

Air Conditioning	The mount you have purchased allows for the use of the 3.1's AC system. If you do not have AC, the Idler pulley can be bolted on to the front cover and will work with a drive belt from a **BLANK BLANK.**
Accessory Drive belt	Use an accessory drive belt intended for a 3.1.
AC Compressor Mount Bolt	You will need to get a Bolt that is: **BLANK BLANK**

O2 Sensor	A new single wire 3.1 GM O2 sensor should be used but must be relocated into the exhaust pipe close to the exhaust manifold as there is not enough clearance with the power steering rack when put in the stock 3X00's mounting hole. An O2 Sensor plug must be purchased from an exhaust shop to plug the original location. An old broken O2 Sensor may also be used if absolutely necessary.
Exhaust Down Pipe	The exhaust can be done two ways, Either have an exhaust shop build you an exhaust pipe with a flex joint to connect the Manifold to the Catalytic converter. Or have them build and adapter pipe similar to what was on the 3.1 originally that will allow the use of stock shaped exhaust systems. In either case this is where the O2 sensor must be mounted.
Shifter cable Heat shields	Buy heat wrap from a performance shop. I used **BLANK BLANK**
Oil Pressure Sender	You must end up with and Oil pressure sender that is compatible with your gauges and has the correct thread size and pitch. The 1994 Cavalier Z24 does. Other Sender units can work.
Knock Sensor	The knock Sensor from a 3.1 works fine in the 3X00's location.
MAP Sensor	Use the 3.1's Map sensor.
Ignition Module	Use the 3X00's Ignition module and mounting system.
Gaskets	You will need appropriate gaskets wherever you wish to re seal. The upper plenum and the Oil filter adapter will absolutely have to be replaced. Except for the EGR and the oil filter adapter, use the gaskets for your 3X00 engine. For the EGR it will be a combination of new and old gaskets new style near the engine, and old style near the old EGR valve. The oil filter adapter uses the 3.1 gasket.
Motor Mount Bracket	You have purchased this mount from me, you will need two metric nuts. 8mm x 1.25(CHECK THIS)
Manual Transmission Oil	You must purchase this from GM.
Coolant	Use good quality Coolant
Engine Oil and filter	Have two filters and eleven liters of oil.

Actual swap instructions.

You need a manual for your J-Body and a manual for the vehicle your engine came from.

If you have a manual transmission, you will take the engine out separately from the transmission. If you have a manual transmission it is easier to take the engine and transmission out as one piece.

Disconnect the battery. Drain the engine oil. Drain the coolant. If it is a manual transmission, drain the transmission fluid. Remove the hood.

Disconnect the electrical connections and vacuum lines on the top of the engine and manual transmission if so equipped. BE CAREFUL TO PROPPERLY LABEL ALL CONNECTORS AND VACUUM LINES AS THEY ARE REMOVED. Labeling now will save a huge amount of grief later.

Disconnect the coolant lines.

Remove the air cleaner assembly.

Disconnect the throttle, cruise control and automatic transmission kick down cables, as applicable.

Disconnect the power steering lines.

If the car is equipped with a manual transmission you must, disconnect the clutch line if you car has an internal clutch slave cylinder, or remove the slave cylinder if it is external. You must disconnect the shift linkages and the vent tube. Undo the brake master cylinder from the brake booster and carefully move it towards the driver's side.

Removing the coolant reservoir can make the swap easier.

Now lift the car so that you can work from below. Follow all safety precautions when working under a vehicle.

Remove the wheels.

Remove the passenger side splash shield.

This section is applicable if the car is manual transmission equipped. Remove the driver's side splash shield, disconnect the lower ball joints, and remove both axel shaft assemblies. It can be nearly impossible to separate the passenger side axel from the intermediate shaft, if this is the case you must remove the intermediate shaft while the engine is in the car. Be careful this shaft's bracket is attached to the rear engine mount bracket. Remove the transmission dog bone mount. Remove the speedometer cable. Disconnect the vehicle speed sensor connector, and label it.

If the vehicle has an automatic transmission, follow this section. Disconnect the starter wiring, and label it. Remove the flywheel inspection cover. Remove the torque converter bolts. Undo the lower transmission to engine bolts. Use a very long extension from the passenger wheel well to remove the lower rear bolt.

Disconnect the exhaust down pipe.

Remove the accessory drive belt. Disconnect the Air Conditioning compressor and tie it to the vehicle to prevent it from falling.

Disconnect the rear engine mount nuts.

Remove and label all engine electrical wiring accessible from below.

From above, hook up the engine lift. With manual transmission vehicles you must connect the lifting chain closer to the passenger side so that the engine tips with the transmission hanging low. Attach the lift chain to lift the engine level if equipped with an automatic transmission. Support the engine with the engine lift.

Now remove the front engine mount bolts.

If equipped with an automatic transmission, remove the transmission to engine bolts. Separate the transmission from the engine.

If equipped with a manual transmission, remove the transmission engine mount and bolts.

Remove the front engine bracket to body mount. If manual transmission equipped, remove the driver's side transmission mounting bracket to body mount.

Support the automatic transmission with a floor jack.

Slowly lift the engine, watching for anything that is still connected. Disconnect as needed.

Transfer the alternator and bracket assembly. Install the Knock sensor from the 3.1 and install the appropriate oil pressure sensor.

If manual transmission equipped, you must install the flywheel, clutch and pressure plate and bolt the transmission to the engine. Install the starter. If you were able to separate the passenger side axel shaft from the intermediate shaft, install the intermediate shaft.

You will have to trim the flywheel inspection cover. With a manual transmission, trim and install it now. With an automatic, wait until the engine and transmission are bolted together and then trim and install it.

Install the rear engine mount. If you were not able to separate the intermediate shaft, then you may have to install the rear mount, once the engine is in the car and the shaft is installed.

Install the front engine mount bracket. Install the AC Compressor bracket. Install the upper bolts in the engine bracket, install the lower bolts through the AC bracket check for space between the upper bolt hole and the welded on nut, shim with washers as needed.

Install the oil filter adapter. If your 3X00 engine had an oil cooler, you must remove it and plug the coolant line fitting with a ¼ inch pipe threaded plug.

Install the power steering lines, as shown earlier. Be careful not to kink the tubing.

Remove the tensioner and idler pulleys from the 3X00 engine. Install the belt tensioner from the 3.1.

Install an oxygen sensor plug in the exhaust manifold.

With manual transmission cars, cover the shift cables with heater hose slit down the side. Cover the heater hose with heat reflective tape.

Attach the engine lift and chain the same way as it was when you took the engine out. Carefully lift the engine assembly and lower it into the vehicle.

With an automatic transmission, carefully lineup the engine and transmission, and install the transmission to engine bolts.

Connect and install all engine mounts.

Installation is the reverse of removal.

The engine fits in the same as the 3.1, with the following exceptions: Fuel lines, wiring, vacuum lines, coolant lines air filter assembly, and the exhaust system.

Fuel lines must be connected using high-pressure fuel injection hose with high-pressure clamps. You can cut the fuel lines from the 3.1 to give you somewhere to attach the hose.

Wiring must be removed from the harness and routed to the new component locations. The ignition module ground can be connected to the ignition module mount. You must modify the 3.1 injector harness so that the circuit stays the same, but the physical routing and the injector plugs match the 3X00.

Vacuum lines must be routed in a very similar manor to the 3.1. Use a ¼ inch steel line under the upper intake manifold to run to the charcoal canister from the T connector that is connected to the PCV valve. Connect the Heater AC vacuum system to the rear vacuum port on the passenger side. Connect the map sensor and the fuel pressure regulator to the rear port on the driver's side. Connect the power brake vacuum booster to the large port on the back of the upper intake.

Coolant lines must be run again, in a similar manor to your 3.1. If you have a newer J body, the heater lines come out from the engine to the heater core on the transaxle side of the engine. This is similar to the 3400's heater hose orientation. The pipes that come off the engine will have to be bent to clear the master cylinder and any other obstructions. You should also keep in mind that you do not want the hoses running physically higher than the coolant level in the coolant reservoir, if they do, you may end up with air trapped in the heater hoses and no heat.

If you have an older J Body where one heater hose comes out on the transaxle side of the engine, and the other comes out by the water pump and goes around the engine, You will need to use creativity. The pipe fitting that comes out of the water pump housing can be rotated 90 degrees so that the pipe that would feed coolant to the throttle body heater and then the heater core, gets cut short, and feeds coolant to the pipe that runs under the upper intake manifold. Then the pipe that used to feed the pipe under the upper intake manifold is in the right spot to feed the heater line by the coolant reservoir. In order to rotate this pipe assembly, you tap the flange off with a hammer and a large socket and then rotate the flange, then tap the flange back in place. I used RTV (silicone sealant) around this fitting to ensure a good seal.

You must make, or have made, an air filter assembly. I recommend a cold air intake.

The exhaust system must be fabricated after the rest of the engine swap is complete. You must have a nut welded into the down pipe as close to the manifold as possible for the Oxygen sensor.

Once the engine has started and run enough to warm up, it is a good idea to do an oil change.

After the oil change Coolant is the biggest worry, make sure you get it topped up. Carry coolant with you for a while after the swap.

Now check for leaks and trouble codes. Get the exhaust done. And drive extra carefully until the bugs are worked out of your swap.

If you have any questions, Call Rick at 1 (877) 818-9788