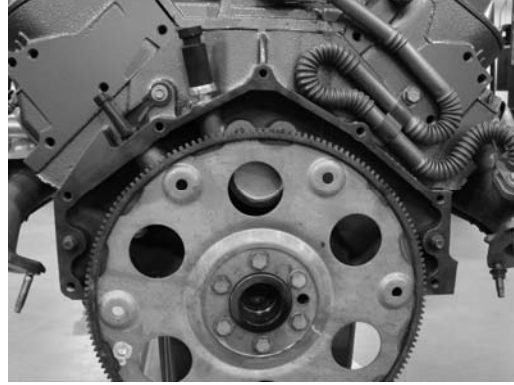
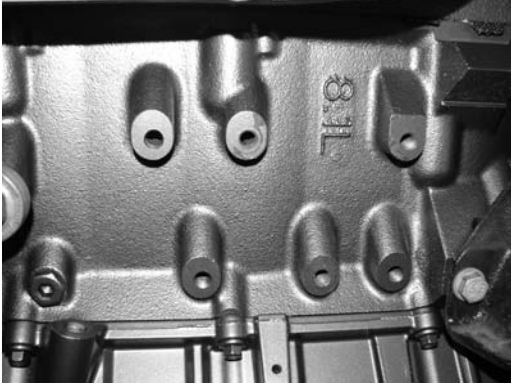


Chevrolet 8.1I swap into 88 one ton four wheel drive by Gary Puls

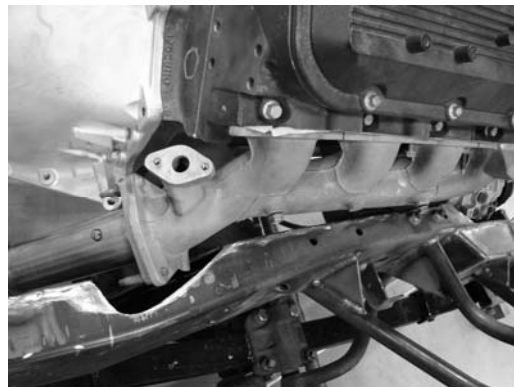
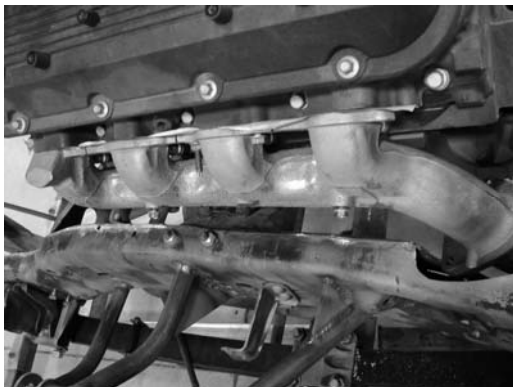


The Chevrolet 8.1 liter engine was produced from 2001-2006 and installed in HD 2500 and larger trucks and vans, as well as motor homes, Suburbans and Avalanches. It is similar to previous big blocks, but has the advantages of better cylinder head and intake manifold flow than the earlier 7.4 liter engine did. It has larger displacement from an increase in stroke. It is factory rated at 340 HP @ 4200 rpm and 455 lb/ft of torque @ 3200 rpm The following chronicles the fabrication and modifications required to install a 2002 8.1 liter Chevrolet engine into a 1988 one ton crew cab.

The 8.1l engine has bosses for old and new style engine mounts. You may use your existing engine mounts with this configuration. The bell housing bolt pattern is the same as previous small and big block Chevy's. Note that all fasteners in this engine are metric. The flex plate is unique to the 8.1l. Note the crankshaft sensor, oil pressure sensor, and the EGR valve tubing in the picture, below right.



The frame rails on the Silverado pickup (in which these engines came in) are wider than earlier trucks. This creates some clearance issues with the frame, firewall and engine cross member. Since the complete frame on this truck was going to be boxed, I decided to use the manifolds that came with the 8.1l as they are cast out of stainless steel and have the port for the EGR tubing. One could use headers for an earlier big-block, but be sure to check clearances as the 8.1L uses a tall-deck block. Other wise, the flange bolt pattern is the same as other big-blocks. The frame rails need to be notched, back by the exhaust manifold to flange area, and the top edges of both sides of the frame need to be trimmed back to make room for the heat shields. You are removing a fair amount of material, so be sure to box all of this in with 3/16" plate to strengthen the frame.

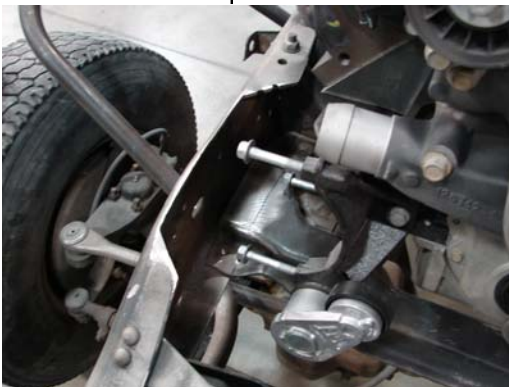




Another clearance issue is the LH front corner of the oil pan. This was corrected by first cutting a hole in the cross-member, fabricating a piece out of 3/16" flat stock to fill the hole and welding in.



A somewhat major clearance issue was the right frame rail. The air conditioning compressor is definitely in the way here. I removed the top of the rail to make room to clear the compressor, and the reinforced the outside of the frame to get back the frame thickness I had to remove. Aftermarket accessories, such as those available from Street & Performance will help you avoid these issues. I wanted to keep all of the factory parts for availability issues since this truck will be on the road quite often.





If you decide to keep the EGR valve functional, like I did, beware that there is not much clearance between the tubing and the firewall. I later increased this clearance by trimming the pinch weld. The valve itself had to have some of the cooling fins removed for firewall clearance.



I used stock oil cooler lines to plumb in the auxiliary engine oil cooler. I cut the tubing before the factory crimp, next to the rubber section. (These are prone to leakage anyways). I then TIG welded a -10 A-N fitting to the end. This allows high-quality Aeroquip A-N hose and fittings to be used from the pipes to the cooler.



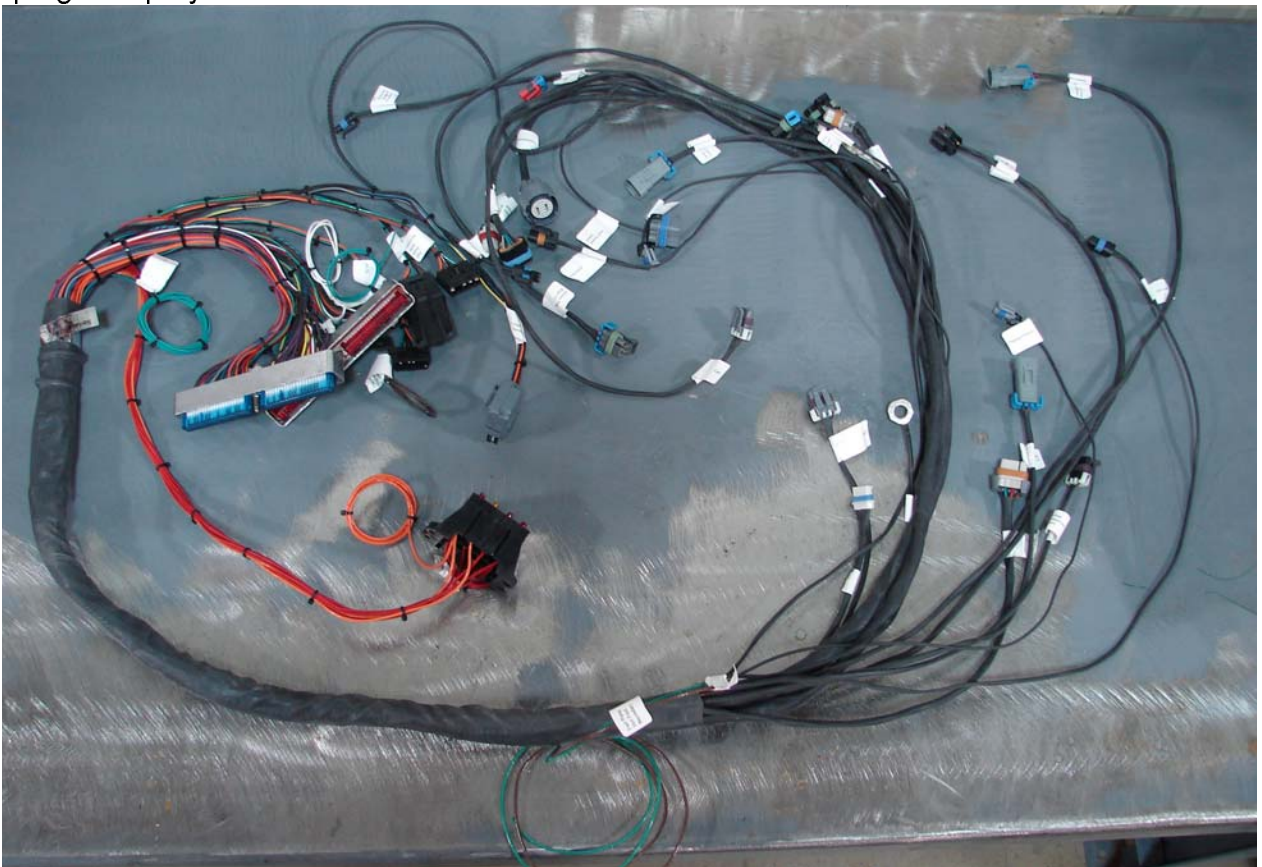
These are the fittings that the oil cooler pipes connect to. They are next to the driver's side oil pan rail, in front of the oil filter

For the fuel system, I used compression fittings from Street & Performance, which allowed me to adapt from the 3/8" and 5/16" fuel rails to -6 AN. I then bent up stainless steel 3/8" hard lines which run all the way to the fuel cell. One is supply; the other is the return line. Below shows how I ran them down the transmission bell housing. Take care to route the lines away from the exhaust. I used a portion of flexible hose between the engine and the frame to allow for flexing as the engine twists. Note where bungs were welded in for the oxygen sensors. Be sure to specify if you are running two or four oxygen sensors when you are having your PCM programmed.





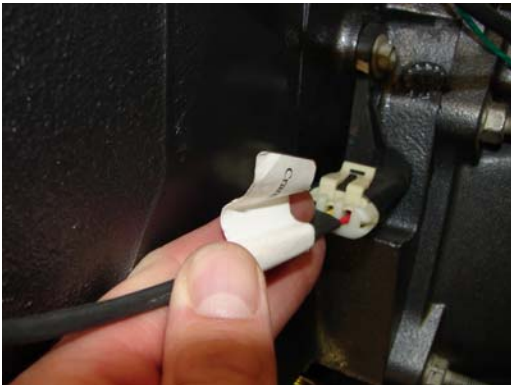
Here is the Street & Performance wiring harness, laid out before installation. Note that all of the connectors are labeled, which makes your job easy. It is truly "plug and play".



The 8.1 engine uses "Drive by Wire" throttle control. Shown is the TAC (Throttle Actuator Control) module, and the pedal position sensor (or pedal). The pedal is used on 6.5 turbo diesel C/K trucks. It bolts directly to the 73-91 Chevrolet truck firewall. Beware the Silverado pedal is a lot less expensive, but does not fit as well.



Plug in the tagged connectors into the correct sensors. You might want to get the pigtail and connector close to the sensor as you will want to route them carefully, avoiding sharp corners and each other before you actually plug them in. Plug all of them in when you are satisfied with the fit.



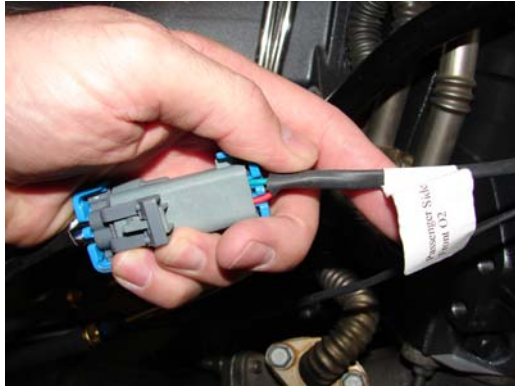
Crankshaft Position Sensor. Note: after this truck was running, I found out that in reverse under a load, the engine would smash the crankshaft sensor into the firewall. GM's replacement has the connector turned 90 degrees which increases clearance and I also bent the pinch weld back to create more room.



Manifold Air Pressure (MAP) sensor



EGR valve



Passenger side O2 sensor



Coolant temperature sensor



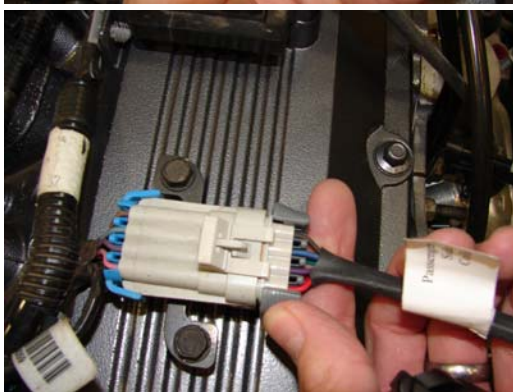
Driver side O2 sensor



Driver side coils



Injectors



Passenger side coils



Driver side knock sensor



Oil level sensor



Passenger side knock sensor



Throttle actuator motor



Canister purge solenoid



Throttle position sensor



Mass air flow and manifold air temp sensor



Alternator



Camshaft position sensor

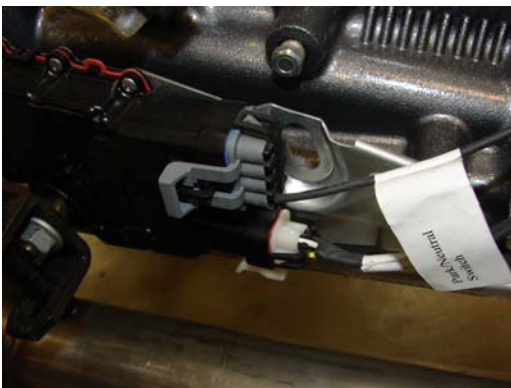
Engine ground wire. Make sure the area is clean to bare metal for proper ground



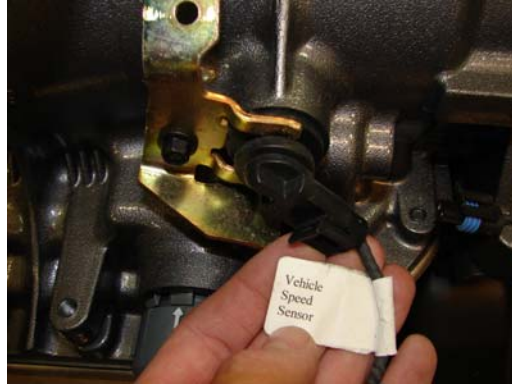
Transmission: I used the 4L85E transmission, which is the heavy duty version of the 4L80E, optional on 8.1 engines. Beware that not all 4L80's and 4L85's have an output sensor if they came in a four wheel drive application. Many four wheel drives use the speed sensor on the transfer case output. I found out the hard way and had to disassemble the transmission and install a reluctor ring on the output carrier. If your transfer case has a speed sensor, you still might have to change the reluctor ring if it was for a TBI engine. I used a New Process 205 transfer case.



Transmission main connector.

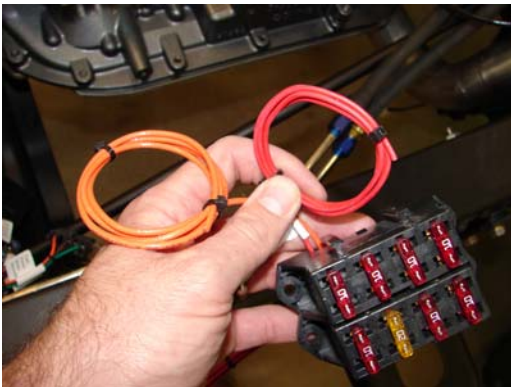


Park/neutral/gear switch



Input and Output (vehicle) speed sensors

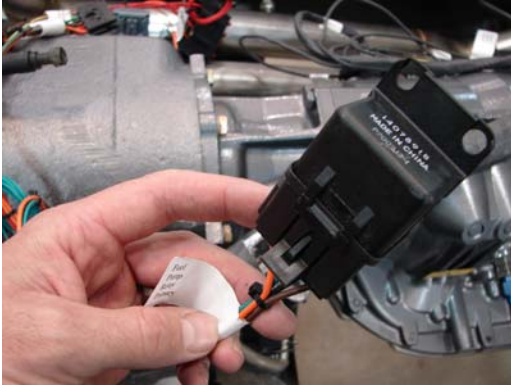
Powertrain Control Module and fuse box connections:



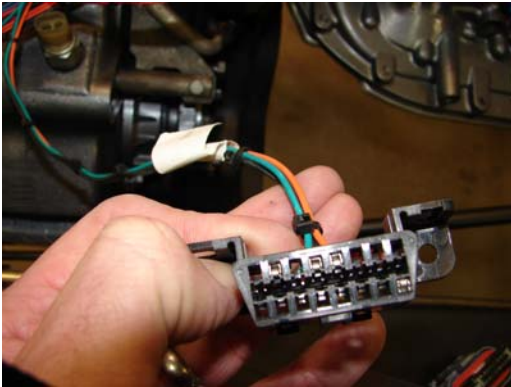
The Street & Performance harness includes a stand alone fuse box. Mount the box in an area where it will be accessible. Connect the orange wire to the battery and the red wire to a 12V source that provides voltage with the ignition switch in the run and crank position.



Other connections out of the PCM connectors: check engine light (connect to the ground side of your bulb), 4K pulse for an electric speedometer (optional), brake switch (connect to the 12V side of brake switch when pedal is not pushed) and tachometer pulse wire.



This is the fuel pump relay which can be mounted under the hood or dash. The brown wire provides 12V to the fuel pump



This is the ALDL plug which is used to interface with the PCM. Mount it under the dash where it will be easily accessible.

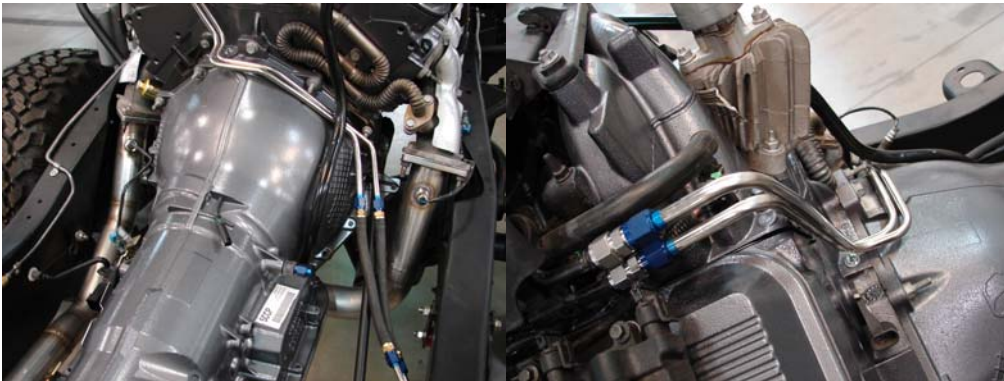
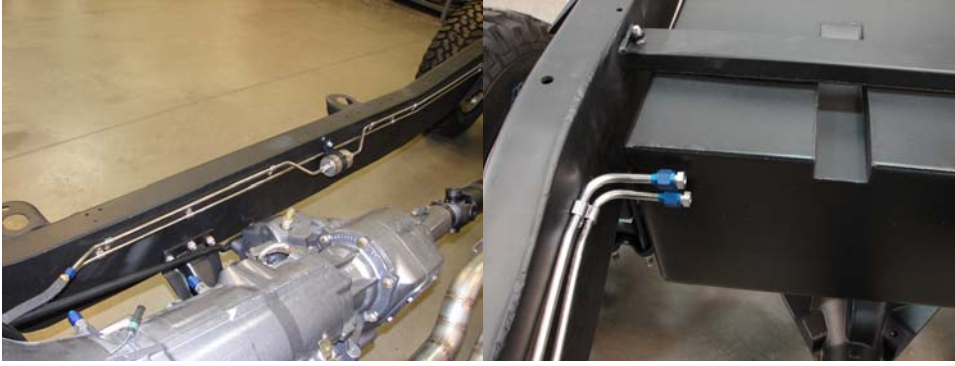
This connector plugs into the TAC module which should be mounted under the dash.



FUEL SYSTEM



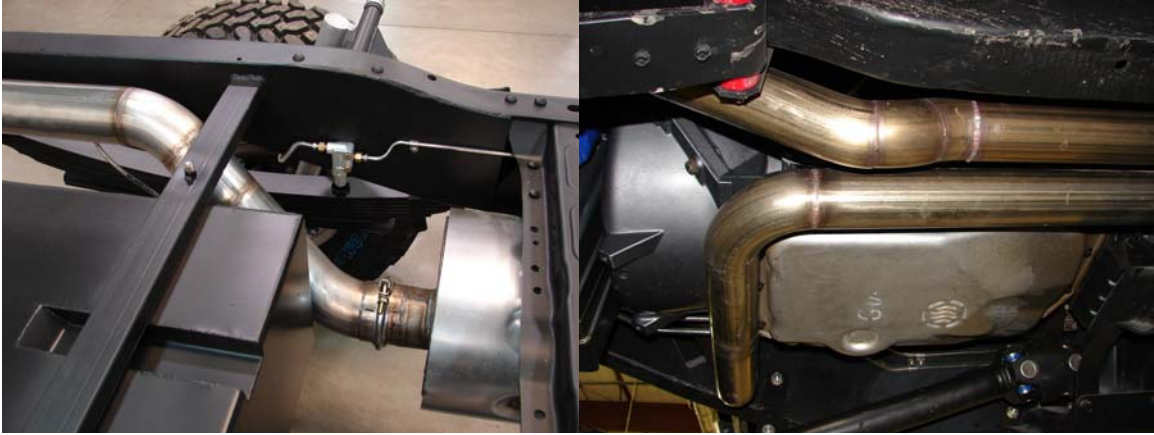
I fabricated a fuel tank for this truck that fits inside of the frame rails. I cut out the top of the original tank (around the fuel sender) and welded it into the top of my fabricated tank. You need to fabricate a baffle around the fuel pump to keep fuel at the pump at all times. The sending unit came out of a mid 90's car with fuel injection. I hit the salvage yard and keep digging until I found one that was the depth I needed.



I built hard lines out of stainless 3/8" tubing for the fuel supply and return line. The fittings at the fuel rail are compression fittings and were purchased from S&P which allow you to adapt to -6 AN. All lines were flared at 37 degrees and a section of rubber high pressure hose was used to allow for engine movement.

EXHAUST



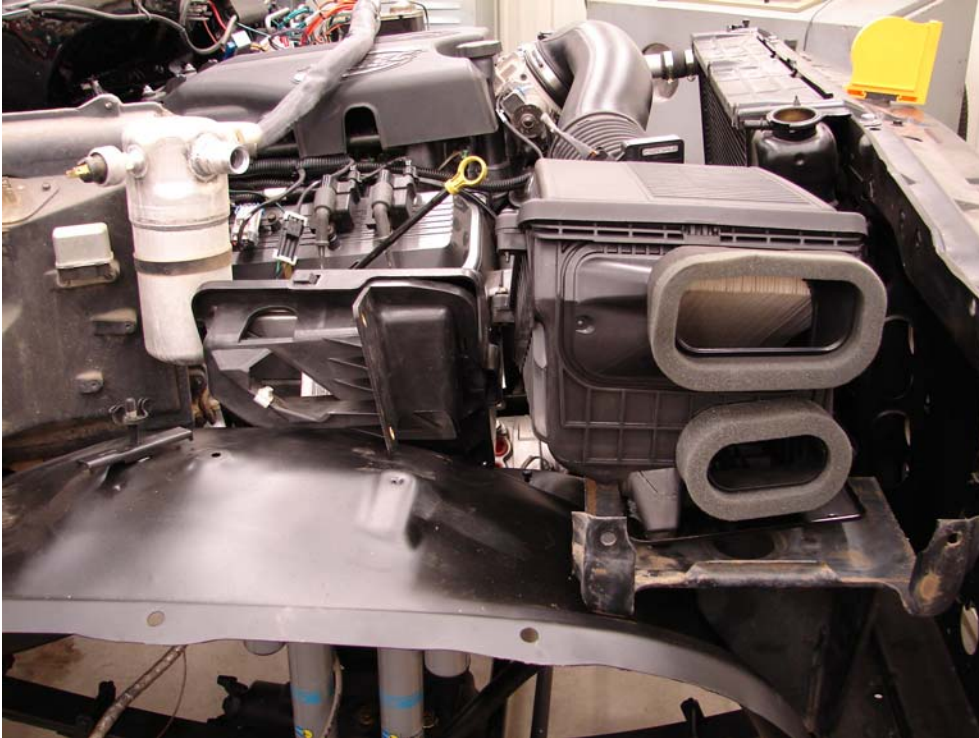


The exhaust system was fabricated out of 304 Stainless Steel tubing and mandrel bends purchased from Stainless Works. It consists of 2 ½" tubing from the engine exhaust manifolds to the Gale Banks muffler. A single 3 ½" tailpipe was fabricated and will exit out of a custom fabricated tip in the rear bumper. Three bolt flanges were inserted in the front pipes to allow easy removal in the case of transmission removal.

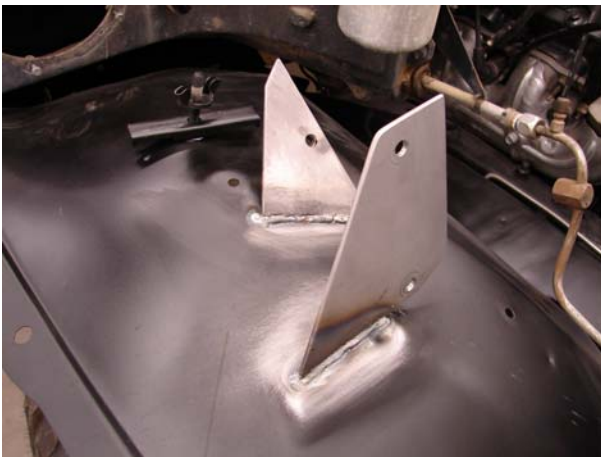
PCM & AIRBOX MOUNTING:



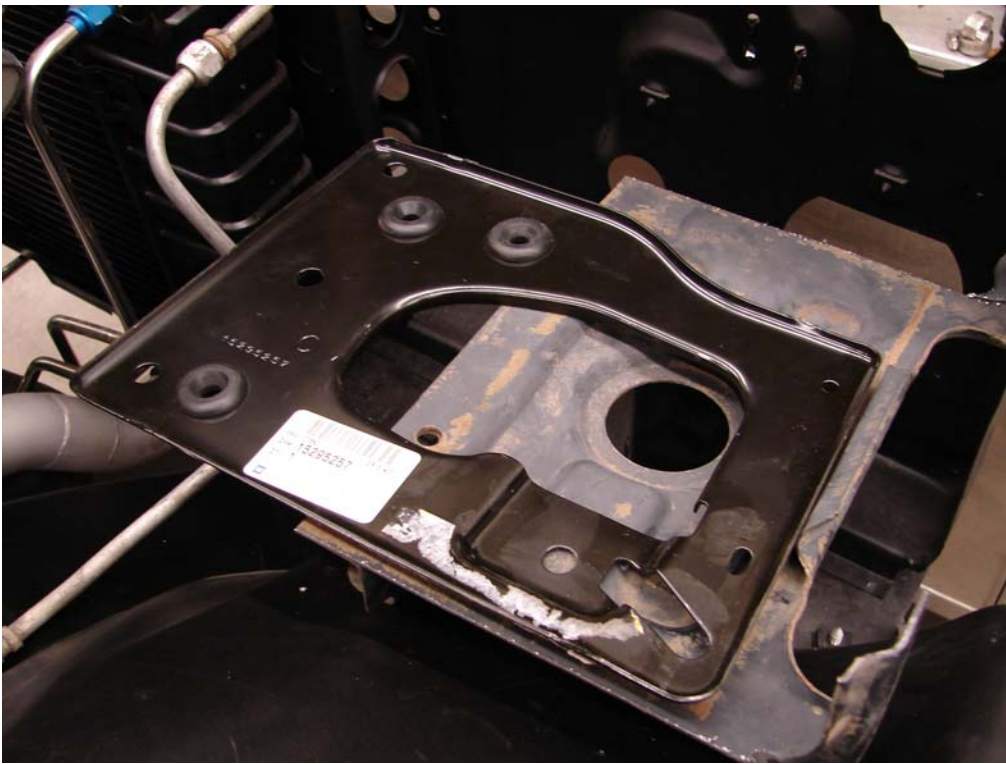
This shows the PCM and airbox mock-up. After mocking up the PCM in the cab, and running the engine harness wiring through the firewall, I found out that installing it under the hood was a better option. The factory has them there as well, so brackets and shields are available. Note that I had to cut the resonator off of the air inlet as it interfered with the fan shroud. I epoxied a cover over the hole it left.



This is a mock-up. Note that the inlet into the air box is designed to seal to the fender. I will fabricate a duct that ties into the radiator core support to ensure outside air gets to the engine.



I chose to install the PCM under hood on the RH wheel house. I fabricated these brackets for the OEM mounts to bolt to and welded them on the wheel house.





Air Box mounting: I used the stock battery tray and the OEM air box mounting bracket to fabricate an air box mount. You will have to relocate the battery to the driver's side. Diesels used two batteries so look for a tray on one of them or purchase one from your dealer.

AIR CONDITIONING:



I purchased the adapters from Doc's Block's (www.docsblocks.com). These allow you to adapt from the Denso compressor to an AN style fitting.



After measuring the thread size on the condenser (small hose shown) and the drier (large hose shown), I determined the length of hoses and that the end that threads onto the drier needed to be 90 degrees and the fitting that threads onto the condenser needed to be 45 degrees. I ordered these hoses from Doc's blocks as well and had them crimped also.



This shows the hoses connected to the A/C compressor. Note the fabricated stainless steel lower radiator pipe.



This shows the hose to the A/C condenser. The factory pipe that connects the condenser to the evaporator was reused.

TACHOMETER



The 8.1 engine's PCM generates a tachometer signal that is half of what a regular v-8 would produce. I purchased this Dakota Digital tachometer adapter and mounted it under the dash. Once wired correctly, I programmed it to convert a 4 cylinder engine signal to an 8 cylinder tachometer. My factory tachometer works great now.

COOLING



Since the PCM and the airbox now reside where the battery and the coolant recovery reservoir did, they were relocated to the driver's side. The Chevrolet military pickup and Blazers used this reservoir and bracket which I installed. The upper radiator pipe was fabricated out of stainless steel tubing and mandrel bends, with rubber hose clamped to seal the ends. All of the radiator and engine outlets are different size, which means I had to use different sizes of tubing and hose.

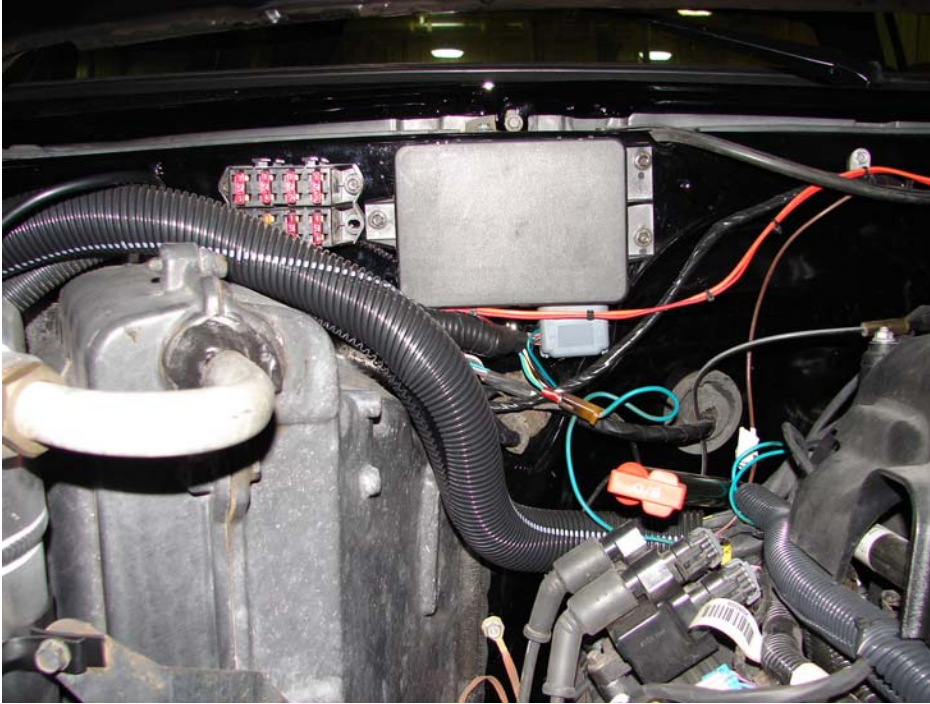
The radiator and shroud are the originals; I did have to use a later fan blade with the 8.1l fan clutch as the 8.1 blade is too large. The original rotates in a different direction, so I used one off of a 1992 Chevrolet truck with a TBI 454.

TAC MODULE, DBW PEDAL and WIRING HARNESS

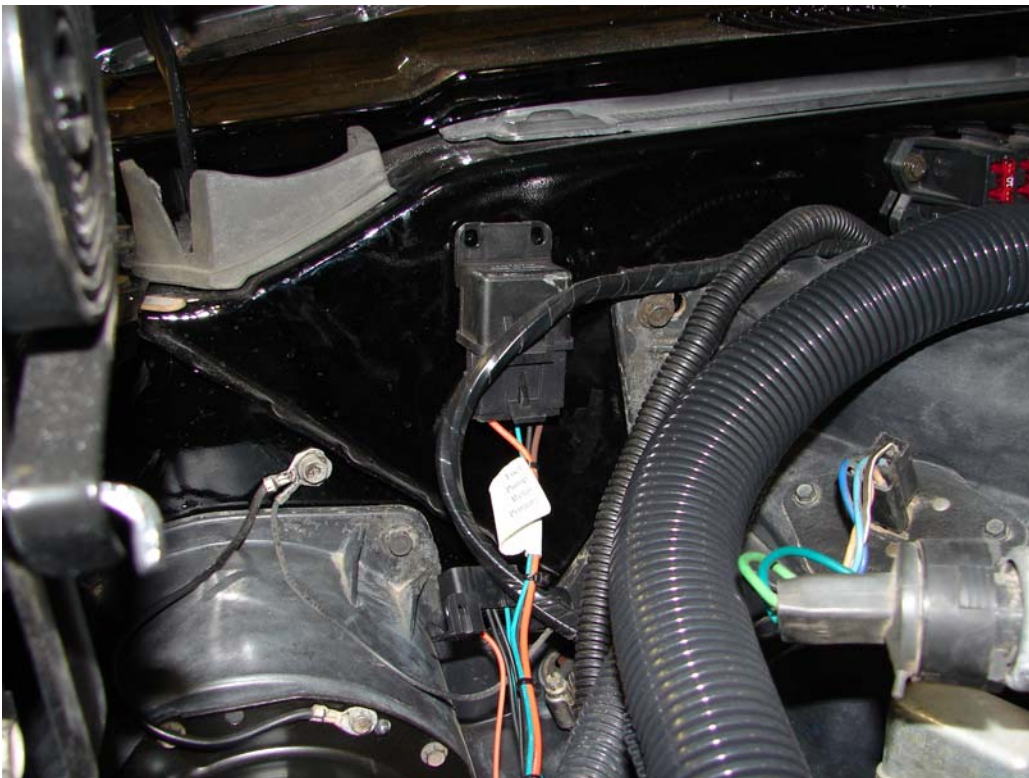


This is the installed Pedal Position Sensor AKA Drive by Wire pedal. I used one from a 1998 6.5 Diesel truck as it bolts right up and is a closer match than the later Silverado pedal. A couple of the wires do have to be moved as it is internally wired different. Basically, there are three different sensors in the pedal and the PCM compares all three of these to determine how much throttle opening the drivers is requiring. If these three sensors do not agree, a code will be set and the PCM takes a best guess at what the throttle opening should be.

The gray wire was moved from location A to J, the Brown wire was moved from location E to A and the Yellow wire was moved from location J to E. I also had to add a slot in the connector plug so it would plug into the pedal.

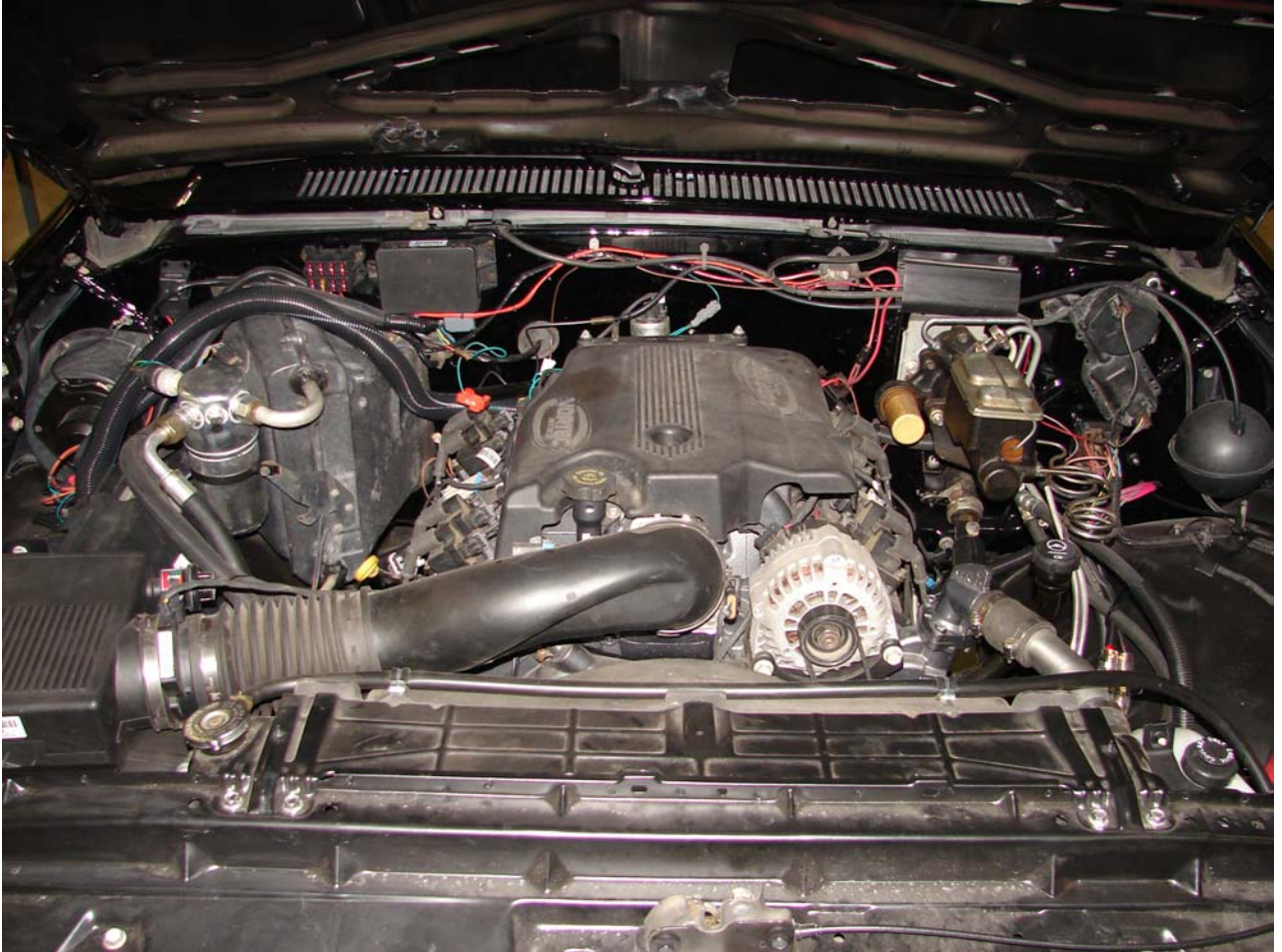


The TAC module and the fuse box were installed on the firewall. The wiring from the TAC module was routed through the factory TBI harness to ECM grommet. The green wire under the TAC module is for the temperature gage in the dash. I connected it to the green wire marked "temp gage" from the PCM.



The fuel pump relay was mounted to the firewall. The ALDL connector is bundled with it's wiring for the moment. I later extended the harness into the cab and mounted the ALDL connector under the dash. All of the harness was covered in convoluted split loom to help protect it and maintain a factory look.

FINAL INSTALLATION



Picture of final installation.

Follow-up/Miscellaneous: At the time I am writing this, the truck has about 400 miles on the installation. I have run into and repaired a couple of issues:

- 1) I replaced the crankshaft sensor as it hit the firewall when under a load in reverse. The truck felt like it had a rev-limiter in reverse until the end of the sensor broke off and the plug came out. The replacement is redesigned and gives more clearance. I bent the firewall pinch weld back as well.
- 2) Vacuum source: There is a pipe plug on the backside of the intake manifold. I procured a 3/8" NPT street elbow and ran a vacuum hose to the vacuum canister. I added a tee into this line and connected the hose to

- this that feeds vacuum to the heater control switch. Many older vehicles or vehicles without factory air conditioning will not need this.
- 3) You might want to talk to whoever is doing your PCM programming. When I first started driving the truck, it was a tire-spinning monster. The more miles I put on it, the less power it seems to have. I believe that the OEM programmed "Torque management" is coming in and limiting its potential. I am looking into having some if not all of it removed. I live at 7200 feet elevation and probably cannot achieve full engine output ratings, even with all of the Torque Management removed. If you live closer to sea level, you run the chance of damaging the power train. My research has found that GM puts this in to help protect the power train from damage and abuse. They retard the timing at shifts and possibly pull fuel from the engine so it can only produce the power they feel is safe. Good idea for the public, but I want more!!
 - 4) Using a Tech 2 scanner, I saw that the Pedal Position Sensor was hitting 100% of throttle opening well before the pedal hit the floor. This gave the sensation that increased power was not being produced when the pedal was getting closer to the floor. I took some bend out of the top bend and added some in the lowest bend on the pedal rod and got it so the pedal indicates 100% right above the floor. It also feels like it is in the right position off of the floor.
 - 5) I added a harness from the cruise control switch in the steering column to the TAC module to allow the cruise control to function. I used the factory cruise control switch connector for one end of the harness and obtained the weather pack wiring terminals from the local GM dealer and inserted them into the existing connector at the TAC module.
 - 6) Connections at the TAC module:
 - a. Pin 5 connects to the "Resume/Accel" signal from the cruise switch (green wire)
 - b. Pin 4 connects to the "Set/Coast" signal from the cruise switch (blue wire)
 - c. Pin 14 connects to the "On" signal from the cruise control switch (gray wire).
 - d. Pin 6 connects to the stop lamp switch (CLOSED with brake applied). Note this is a different connection than the stop lamp switch the PCM harness hooked to as it is OPEN with the pedal applied. You will have to use a stop lamp switch that has two sets of contacts
 - e. Connect the pink and black wire at the cruise control switch to fuse-protected ignition only 12 volt source.
 - 7) CKP reset: You will likely have to stop by the dealership or see anyone with a Tech 2 to reset the CKP position offset. This calibrates the crankshaft and camshaft sensor signals in the PCM.
 - 8) Still working on getting a fresh air duct to the airbox. I am going to fabricate a duct that goes from an opening in the core support, behind the

grill to the front of the airbox. I will block off the openings that sealed to the fender in the original application and cut a hole in the front of the box to attach the duct to.

PART NUMBERS AND SOURCES

Description	Part#	Source
Coolant temp sensor	12554944	GM
Oil pressure sensor	14036243	GM
Output speed sensor	24203876	GM
Park/Neutral switch	24229422	GM
Speed sensor ring	RR1	PATC
Fuel Pump	25163473	GM
Fuel Pump Strainer	25055461	GM
2.5" 3-bolt flanges	FLNG2503	Stainless Works
O2 Sensor bungs	02SS	Stainless Works
Exhaust manifold flanges	FLNGCPH	Stainless Works
O2 Sensors	12565397	GM
Serpentine Belt	12576745	GM
Exhaust manifold shield	12555623	GM
Exhaust manifold shield	12576124	GM
Muffler	52410	Gale Banks
Idler Pulley	12580771	GM
Serpentine Belt	12576747	GM
TAC module	12574221	GM
A/C Compressor	15169965	GM
A/C Compressor connector	3018715	GM
MAF Sensor	25318411	GM
Air Cleaner	88894277	GM
Duct to Throttle body	15059110	GM
Fan Clutch	15712914	GM
Transmission dipstick	15183801	GM
Transmission dipstick tube	15198439	GM
Power steering fill hose	26086329	GM
Clamp for above	11517136	GM
Power steering filler neck	26086332	GM
Power steering pump lwr brkt	12558966	GM
Power steering pump cap	26095239	GM
Power steering pump	88963608	GM
Power steering pump pulley	12573728	GM
A/C Compressor brkt	12570220	GM
Exhaust Manifold seal	15077362	GM
Alternator Bracket	12570132	GM
Serp belt tensioner	12581177	GM

PCM Bracket	15047570	GM
PCM Cover	15071609	GM
Seal, duct to throttle body	25171042	GM
MAF Seal to air box	12101937	GM
Oil Cooler Connector	15765610	GM
Oil Cooler Hose	15065206	GM
Oil Cooler Hose	15753773	GM
Starter Bolts	12561387	GM
LH Battery Tray	15616327	GM
Air box bracket	15295257	GM
Fan Blade	15734247	GM
Tach Signal Calibrator	SGI-8	Dakota Digital