

# Swapping Your Chevrolet 2.8L To A 3.4L

*(written based on S-10 swaps in RWD applications only)*

## Overview:

The 2.8L sixty degree V6 engine was used throughout the First Generation S-10/S-15, Blazer/Jimmy production so it, understandably went through several updates and improvements. In normal GM fashion, not all the upgrades were made at the same time so this clouds the picture.

From 1982 to 1985 engines were carbureted and used a mechanical fuel pump. The rear main seal was a 2 piece seal prone to failure. The bearing journals were a weak spot and spun rod bearings were common. The front [timing] cover is machined for the water pump to rotate in the same direction as the crankshaft using multiple vee belts to drive the accessories. This engine is externally balanced using weights welded or cast onto the flex plate/flywheel.

The year 1986 was a year for big changes. The bearing journal diameter was increased. A single piece rear main seal was added and the heads were upgraded to 1.72" intake valves and 1.42" exhaust valves. The biggest change was throttle body fuel injection (TBI). This system consisted of a 2 barrel throttle body with each bore measuring 1 3/8" with a single injector for each barrel. The injectors sat above the throttle body and mixed with the fuel and air before the throttle blades. An On Board Diagnostic (OBD) 1 computer system controlled the injectors along with spark control for the engine. There was also an in tank electric fuel pump to deliver fuel. Pressure was controlled by a regulator mounted on the throttle body. Pressure was between 9PSI and 13 PSI. Power increased to 125 hp. and 150 ft. lbs. The front cover is the same as the older engines and vee belts were still used and the balance was still external.

1987 introduced the serpentine belt. This required the front cover to be machined to work with a water pump turning in the opposite direction from the crankshaft. The only visible difference between the front covers is the direction of the 'swirls' machined in the area behind the water pump impeller. This makes a difference in the coolant flow and an engine with the wrong front cover will have cooling problems. The belt tensioner is usually mounted with a #55 TORX fastener. The belt driven component brackets were re-designed to hold the components in a stationary position for the serpentine belt. This engine was still external balanced.

1988 is the introduction of internal balanced components. The flywheel/flex plate changed to a neutral balance assembly free of welded or cast counter weights. The 2.8L stayed the same until it was discontinued.

## 60 Degree Evolution:

General Motors continued to utilize the 60 degree engine in various RWD and FWD applications. The most popular RWD vehicle was the Camaro/Firebird which used the 2.8L through 1990. In 1991 the engine was stroked into the 3.1l for a 10% increase in displacement. The block stayed the same and is a direct bolt in replacement for a 2.8L engine. In 1993 the block casting was strengthened and bored to 3.4L for another 10% increase. The FWD version made the same advancements and the D.O.H.C. 3.4L in the Grand Am shows how far GM took this design. FWD engines are utilized in transverse mountings and have the starter mounted on the opposite side

when compared to RWD engines. FWD engine also use different motor mounts, thus the block does not have the mounding holes drilled and taped for RWD mounts. First generation FWD engines used the same cast iron heads and the RWD vehicles but later changed to an aluminum head. The aluminum heads are NOT available with an intake for TBI or Carbureted engines. There are ways to convert you vehicle to using a different fuel injection system along with these late model heads and intakes. But this article will not discuss these possibilities. For choosing a block it is recommended to choose from RWD blocks to ease your swap.

### **Sources of 3.4L Engines:**

The ideal used engine is the 93-95 Camaro and Firebird and they are readily available throughout the US and Canada. Engine re-builders sell 3.4L long block setups for the Camaro. The Ideal NEW engine is the GM HT 3.4L Crate engine.

The GM HT3.4L is GM's bolt in, long block for carbureted 82 to 85 S-10 vehicles. Their advertising says it cannot be used on TBI applications because GM only emissions approved it for 82-85 automatics. This is due to each variety [auto and standard] needing their own approval and the newer EFI units would need the same. They cannot recommend that you use the engine for an application that is a violation of the Federal Air Pollution laws. When you consider the requirements of installing the crate engine in an 82 to 85, it becomes clear that it is more suitable to the newer (EFI) vehicles. *Using this block in and EFI vehicle however, will void the factory warranty on the engine.*

If you are going to use the crate for a TBI truck the crate engine comes with the front cover for vee belts, You must change this (except on an 86) so your water pump will work properly. Remember it was discussed earlier that the serpentine belts require the water pump to turn in the opposite direction that vee belts do. Then ALL of your existing 2.8L accessories, sensors, manifolds, mounts, a neutral balance flywheel (if applicable), intake and throttle body.

For a carbureted engine you need an electric fuel pump because there is no place on the block to mount a mechanical fuel pump, this applies is using the crate or a Camaro engine. Also 82 to 83's with a cable clutch need to change over to a hydraulic clutch system because there is no 'boss' for the clutch cable pivot. Also it is recommended to install a fuel pressure regulator for your carburetor, you can however use the regulator on the old mechanical pump but this is a jobber solution at best. Then continue with swapping over all of your existing 2.8L accessories, sensors, manifolds, mounts, a neutral balance flywheel (if applicable,) intake and throttle body.

If you have chosen to use a Camaro engine on your TBI truck with serpentine belts remember that the Camaro was a car that used a serpentine setup. BUT you still need to remove the pump and front cover and use your S-10 components. The front cover does not have a pointer on it to set timing and the pump will not work with the S-10 pulley which will be needed for your clutch fan. However, there is one exception. If you are going to use an electric fan for your S-10 you can use the Camaro water pump for your swap. The Camaro pump uses a smaller pulley, this will not cause any problems as the tensioner will absorb the small amount of extra slack. You will actually benefit from an over driven water pump and have more water flow. If you are using the Camaro engine for a carbureted truck everything on the Camaro block must go and you must use your original S-10 parts.

### **General Swap Information:**

Serpentine belt front covers will not work on vee belt engines. In 1986 The S-10 used a combination vee belt and serpentine belt drive. This truck still uses the normal vee belt front cover.

Anyone with a 4X4 needs to swap the oil pan and pick up over to the 3.4L as the 4X4 has a different sump than the 4X2 and the Camaro.

A Camaro oil pan will NOT work on an S-10. Always use your S-10 oil pan weather it be 4X4 or 4X2 or the crate pan if you own a 4X2.

If you have a truck (4X4 or 4X2) with vee belts and you are doing the Camaro swap it is suggested that you buy a new style oil pan that came on the serpentine belt equipped trucks and the crate motor's front cover. This new style pan will mate with the crate motor's front cover and you will NOT have to use the old style cover. The old cover and pan's design is far inferior to the newer setup. The new setup also uses a rubber gasket which will seal much better. If you are doing a crate swap then 4X2 owners will have no problem. 4X4 owners should buy a new style pan to mate with the crate motor's front cover. However if you are on a really tight budget with your swap then you may use the old style pan and cover. Remember that they MUST be use together you cannot mix and match parts.

TBI systems from 2.8L engines will run lean on a 3.4L unless you make some modifications. *This will be discussed later in the article*

Remember that if you are not using a new engine you are using something with WEAR always inspect a used engine. Cam, lifters, timing gear, bearings and seals all need to be checked and replaced if bad.

The Camaro engine can be re-cam'd w/ a low-mid torque cam like the one in the crate engine. This is a good solution for camshaft wear.

Your 2.8L headers and other bolt on items will fit onto the 3.4L block.

Always prime the oil system in any 60 degree engine. The hex shaft under the distributor fits a 6point 8mm socket. Tape it onto an extension and use a hefty electric drill to turn the oil pump until oil comes up ALL the pushrods. Smaller drills won't have enough torque once the oil starts to fill the system. You should fashion some sort of plug to go in the distributor hole because the right hand lifter galley ends at the distributor hole and if left un plugged no pressure will build in that galley and the rockers wont get oil. You can use an old cut off distributor body to do this. If you have a Camaro engine you can cut apart the oil pump drive plug to do it.

TBI systems have two temperature sensors, one in the intake manifold and one in the corner of the driver's side head. The plug in the head has an 8mm square hole. This is hard to find. On a new crate engine, ROBO GRIP type pliers can remove the plug. Vise Grips won't. You may also have success by grinding down an old 3/8" extension to fit the plug. If you want to buy the tool then MAC and Snap On sell them in sets. NOTE: the passenger side head has the same plug facing the firewall. This would be the ideal place to hookup an aftermarket temperature gauge.

The Knock Sensor screws into the water jacket on the starter side. On Camaro engines it is close

to the motor mount and clears the starter. The crate engine only has one threaded block drain and it's close to the starter. They don't look like they would interfere when the engine is out and the exhaust manifolds are off. The plug won't hook up to the knock sensor as the small wire on the starter solenoid is in the way. A 1/4" x 1" NPT pipe nipple and a 1/4" elbow move the sensor away enough to hook it up. Do this before the engine is installed.

ALWAYS change the o-ring on your distributor. When you do this tape the shaft of the distributor with electrical tape all the way from where the groove for the o-ring starts to the very bottom the the gear. This will protect the new ring from any nicks or cuts. Then slide the o-ring, coated in oil, up to the groove where it sits.

The rotor points to 7:00 o'clock when #1 is at TDC Firing. When the distributor starts to come out, the rotor will move to 6:00 o'clock position. When you install it; start with the rotor pointing to 6:00 o'clock and it should swing over to 7:00 o'clock. The new o-ring will make it snug, work at it till it is completely seated. Make sure that the engine is on compression and the timing marks are lined up at zero. If it won't start, line the marks up and take off the cap. If the rotor is pointing at 2:00 o'clock; you were 180 degrees out, do it over.

Camaro flywheels are thicker than S-10 flywheels so you can't use a Camaro flywheel in the 2.8L bell housing because there is no room for the fork. 82 thru 87 truck owners with manual transmissions need to obtain a neutral balance flywheel from an 88-93 2.8L S-10. Or have a machine shop remove the weights and neutral balance the flywheel with a flywheel resurface, this would be as good as buying a new flywheel.

In your Camaro block you will notice some extra holes. These come from the cam position sensor, the crank position sensor and the block heater (if equipped). Fill these holes with the proper sized frost plugs to ensure a quality swap. NEVER just cut the wires short and leave the sensors to keep the hole plugged.

You cannot use any of the Camaro accessories on a TBI truck because they all have some differences from the S-trucks. The alternator has the same internals and in theory would work but the case is different. The power steering pump is the same on the outside but the pressure regulator is different, as it was use on a rack and pinion system in the Camaro. The water pump, like the alternator, is the same inside but the shaft and snout on the pump is a shorter length, While you can use the Camaro water pump and pulley, you cannot use it with a clutch fan.

The starter for both engines are the same inside and out except for the 12 volt supply post on the 2 are different sizes. The S-Truck one is larger than the Camaro.

When putting on the engine mounts from an S-10 on to the 3.4L you may have to grind part of the mount to clear the casting around the base of the engine (where the oil pan bolts up) it may be necessary to remove about 1/4 inch of material off the mount.

### **Doing The Swap:**

Drain all your fluids first!

Remove the engine and bell housing as one unit and remove the transmission and drive shaft on their own. The transmission must be removed to free the engine and the driveshaft must come out

to remove the transmission. The drive shaft is removed by unbolting the retaining clips in the rear. If you have a 2 piece shaft unbolting the carrier bearing also. With all the bolts undone slide the shaft forward until it is free from the rear and then slide it back in the other direction to pull it from the transmission. Now remove your cross member to aid in the removal of your transmission. On a manual you can just unbolting the transmission from its bell housing and pull it out. On an auto you will have to unbolting the bell housing from the engine. To do this it will be easier to remove the transmission cross member first and then drop the transmission tail down to make it easier to access the top bolts. Before you drop out your transmission be sure to remove all of the connectors and fuel line clamps. When removing the slave cylinder from a manual you just need to remove the bolts and SLOWLY back it off from the clutch fork. Allowing it to just spring out may introduce air into the lines or even damage the slave or master cylinder. Some people have removed and reinstalled the engine with the transmission in tact but it is much trickier. With your driveline out it is time to move forward with the engine removal.

Drain all your fluids first and disconnect your battery and remove it! Remove the upper fan shroud, unhook the hoses from the radiator and remove it and the lower shroud. Remove the bolts holding the clutch fan to the water pump shaft and remove the fan. Start removing the belt driven items. Remember to keep the power steering pump upright and slide it into the corner behind the driver's headlight, the hoses should allow this but it will leak if it is not upright. Hopefully the A/C compressor can be moved to the passenger side and stay connected (either of the author's trucks did not have air) and all the rest of the accessories and the mounting brackets get removed from the engine compartment. This is a good time to unhook and remove the fuel line and return line from the TBI, watch out for fuel under pressure. Fuel WILL spill, mop it up. This makes a lot of space in front of the engine where one can stand, after climbing over the radiator support, and work on the engine. Use lots of penetrating oil on the exhaust manifold bolts, start applying it a few days before you want to start removing them. The exhaust manifold and 'Y' pipe can stay in the truck. Remove the bolts connecting the manifolds to the engine.

Remember that it really helps to take pictures of the general layout of the engine compartment before tearing things out and it is the only way to remember the location of the items that share the manifold bolts! A shop manual will also be a great asset.

Remove the air filter assembly and note the vacuum hose connections. Remove the distributor. Remove the fuel lines or just move them out of the way. You can choose whether or not you want to remove the intake manifold. If you leave it remove the TBI unit from it, if not the TBI can be left on the manifold and just remove the manifold and TBI as one. Use a 13mm offset wrench, the kind where the opening is dropped below the plane of the wrench handle, to loosen the two middle fasteners blocked by the Intake manifold body. Remove the distributor. The hex shaft that drives the oil pump might come out with the distributor. Remove the coil and EGR controller from the rear lift eye. This will make room to get to the grounds bolted to the back of the driver side head. You should be able to stash the top engine electrical harnesses over the wiring running behind the engine. Pull the bottom harness back after unhooking the knock sensor and the starter wires. Unhook the oil pressure sending unit(s) and unscrew them from the oil filter mount. Set up a chain and your hoist, you should be ready to remove the engine mount through bolts. Double check that everything is disconnected and tighten up the hoist and make sure it starts to lift the engine. Triple check that everything is loose and start lifting. Work the exhaust manifolds around the oil filter, mounts and the starter until the engine is free (the spring loaded bolts to the 'Y' pipe allow them to move around a bit). If you left your transmission on your engine you will have to lift on a very extreme angle to the truck. You will have to work very slow and a few hands may be needed to do some lifting and turning. If you have already removed the transmission then your angle will not be

as extreme but may still require some help so you don't chip any paint. Swap all your necessary components and ready your self for reinstallation.

Some reinstallation tips. When installing the transmission and engine together you will reach a point where the upper engine mounts are sitting on the front half of the lower mount and it seems that it won't go any farther. Get a jack under the transmission tail shaft area and jack the transmission up against the floor boards. This will raise the back of the engine and allow it to be lowered over the bottom mounts. If you choose to install everything separate the just reinstall the reverse of the removal. If you have a manual transmission be sure to align the clutch pack before you reinstall the engine. This will allow easy installation of your transmission. When you install your manual transmission put it in the highest gear (5th or 4th depending) so that you can turn the shaft by hand to allow it to slide into the mating splines. Then shift your transmission into neutral so that it can turn freely to install the drive shaft.

### **Carburetor Owners:**

When you have your swap done you will be fine using your carburetor and fuel delivery will not be a problem. However you may have to adjust your regulator which you will now have if you followed the previous advice given in the article. 12 switched supply will have to be given to your new fuel pump. Some further tuning to fuel delivery may have to be done to achieve a desirable fuel curve.

### **TBI Owners:**

There is a few extra steps involved in your swap. You need to supply more fuel to the engine. The old 2.8L injectors will not suffice. The simplest and surefire way to do this is to buy a set of 4.3L injectors to add the extra fuel. Simple and effective, they bolt right on, no modifications to anything is necessary. Some other option include a custom PROM for the computer. A Holley 502-3 TBI unit will also supply the fuel flow and give some extra air flow.

The 2.8L TBI is equipped with 33 lb/hr injectors, and the computer "pulses" the injectors at a rate commensurate with the 2.8L displacement. The idea is to keep the air / fuel ratio as close to 14.7 to 1 as possible. The computer can adjust for variances from engine to engine and different driving conditions, but the 3.4L is more adjustment than the computer can ideally achieve. As a result, drivability problems, such as hesitation and stalling in open loop, are common with 3.4L engines running stock 2.8L injectors. Installing the 4.3 injectors (45 lb /hr injectors) solves these problems and improves overall performance by allowing the injectors to flow more fuel using the same band pulse width (BPW) that is programmed in the 2.8L ECM. Running the 3.4L engine with 2.8L (33 lb/hr) injectors can cause a dangerously lean condition, especially at RPM's above 4000 because the air to fuel mixture is far too lean than what is required.

Sources for injectors are abundant. The cheapest option is to go to a salvage yard and pull injectors off a 4.3L engine. Look for the newest ones you can. When you get them home it is HIGHLY recommended you get a rebuild kit and replace the gaskets and o-rings. Or just go out and buy a new set. GM OEM injectors are the injectors of choice but several makers offer their own equivalents.

When you are ready to install them there could be nothing simpler. Assuming the TBI is already installed on the truck. Remove the air cleaner assembly. Un bolt the 2 fuel lines from the injectors. There is one o-ring on each of the lines. If these are cracked or hard they need to be replaced or they will leak. After you remove the fuel lines, un clip the wiring harness. Un screw the 3 Torx bolts

holding the injectors to the base. Remove the injectors. If the injector base gasket is damaged then replace it. Now place the new 4.3L injectors on the base and screw them down. Reverse the rest of the procedures to finish the job. Start the truck or apply power to the fuel pump prime lead and check for leaks. If there are no leaks have fun!

## **Final Thoughts:**

This article was written twice. First it was based on installing a HT 3.4L crate engine into a 1988 Tahoe, small cab/long bed 4x2 truck with a 5 speed transmission. The decision to pull engine and transmission together was based on the author's previous experience changing a clutch. The top two bell housing to engine bolts are almost impossible to remove and the T-5 seemed more compact than an automatic so it seemed possible. Tractor trailer jack stands were used under the rear axle and the front air dam was almost on the ground. This might not be achievable by many people that don't have a level concrete floor and huge jack stands to work with. One alternative would be to strip off the intake and both heads. One person used to say you could then straddle the engine block and get at those two top bolts. Later this article was revised when the second author used a Camaro engine to install in a 1993 GMC Sonoma, extended cab, 5 speed. This author first removed the engine with the transmission, based on previous advice. But realized later it was better to remove the transmission from the bell housing instead. This is how the engine was reinstalled. The clutch pack was first aligned with an alignment tool.

Working alone, the first author spent almost thirty hours, working nights after work (used a bay in the shop at work) and one weekend to complete the swap. One shop mechanic helped for around 15 min. He had the idea to raise the transmission to get it to fit. A forklift was used to do the lifting and the shop parts washer allowed each part to be cleaned after it was removed. Groups of parts and their fasteners were stored in big zip loc bags and piled inside the cap covered bed. The crate engine was kept inside its bag until ready to dress w/ the parts off the 2.8L. It is easy to change the clutch when the transmission and engine are sitting on a skid!

The crate comes with a cardstock covering the intake area. This was removed and a bunch of clean rags covered this area and the cardboard was placed over the rags. The intake was installed after the engine was back in the truck and the distributor waited until the engine was filled with oil and the oil system was primed. You cannot use a wimpy drill to prime the system as the building pressure results in the need for a lot of torque to keep the oil pump turning. Make dams out of rags to keep the oil from spilling all over and prime the system until oil comes out of ALL the pushrods, the last few will take some time to get oil.

The second author did the swap in a house garage. However, it was very well equipped. Lots of help was on hand. The swap was done over a longer period of time and several modifications were made to the engine. Everything was cleaned when removed and then bagged or put in groups with its relating parts. The Camaro engine was fully rebuilt, cleaned and painted.

4X4 Swaps are similar. One person said that she did not even remove the transmission and transfer case from the vehicle and just left it supported by jack stands.

For further information you can always make a post on your favorite forum.

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