3.1L V6 SFI to 3.4L V6 SFI Engine Swap Guide

By: Ryan Pettersen

Version 2.5.6

Now if you're reading this, you probably own a Grand Am/Achieva/Skylark/Monte Carlo/Malibu/Grand Prix equipped with the 3.1L V6, and you want to drop in a 3400. Do you have a 1992 or 1993 or a 1996 through 1998 model? There ***will*** be parts and/or instructions that you need that I haven't listed here or mentioned, but that you have to figure out on your own. I'm not familiar enough with the 3.3L V6 (found in 92 through 93 models) or the older 3.1 MPFI's, to give you any help here. There is some info here for '96 through '98 cars, and more to be added as needed. The engine compartments are almost unchanged for all of the years and models that the 3100 comes in.

Be sure to read the FAQ first! The people that I *specifically* wrote this for are the ones who own a 1994 or 1995 car with the 3100 V6 SFI. But that does not limit what this guide can be used for. Some of you may also want to use this guide just to help you with some other project that you have for other 60º V6s. Who knows? It should be very helpful anyway you use it. The swap for most people should take not more than 2 to 3 days to complete.

Now a note about the parts prices that I have listed, the absolute best place for brand new GM OEM parts is gmpartsdirect.com. So when ever I refer to a parts price, that's the place where I get it from. Be sure to check it out. This publication is subject to change.

Be sure to check out ***3400swap.com*** for more information!!

Disclaimer! :

I can not be held responsible for anything that goes wrong with your car as a result of you following this guide,
Or doing the 3400 swap!! **So users beware!!**

Here are some details about the car that I am going to use in the swap:

1995 Grand Am GT Coupe
3.1L V6 SFI OHV (VIN M) (RPO Code: L82)
4-Speed Automatic Transmission w/Overdrive (4T60-E) (RPO Code: M13)

The Guide:

One thing to remember is that you may need a good amount of time to do this, and then when you do that, double it for a good measure. Be sure that you have the parts and fluids and/or tools ready and on hand or ordered in advance, this will speed-up the process greatly.

One of the first things that I had to get done was to get the original engine cleaned some how. If you don't want to do this that is perfectly ok, it will save you some time. The reason I suggest this is because it makes it a lot easier to see things and the mess will be less on your hands. This way you won't have to spend a lot of time cleaning up some of the pieces that you swap over. May be instead of getting it professionally steamed or whatever, you can just use some degreaser and spray out most of the grease with hot water.

I am removing the engine through the top of the car using a cherry-picker. This is going to be the way that, most likely, everyone is going to use. You can either take the transmission out or leave it in the car when swapping engines. I took mine out because the transmission was needed to be fixed anyways.

Be sure to give your self as room as possible underneath the car. It is very hard to work under there as it is.

Here is a checklist of the tools that you most likely will need. This list is just stuff that you probably already own, but it's a "just incase":

Tools:
Socket Wrenches 3/8's, ¼'s, ½'s, all sizes.

Wrenches
Socket extensions
Spark Plug Wrench (if replacing sparkplugs)
Torque Wrench you *will* need one of these, so get a good one!
Deep-well Sockets/Oxygen Sensor Socket
Hex Keys
Flat Head, Philips
Star keyed Screwdrivers
Fuel Line Disconnect Tool
Jack Stands
Good Floor Jack, NOT the Spare Tire Jack, *it won't work, and is not safe!*
Engine Hoist
Engine Stand*
Containers for catching the oil, antifreeze, and any other fluids**
Funnels
Assortment of Pliers and Vise-Grips Clamps
Various Air Tools

** This is optional, I didn't use one. Instead my engine sat on a wood create that it came with.*
*** Make sure you have enough and one large container (for antifreeze) for the job. The most fluid will be the anti-freeze and engine oil (transmission fluid may not apply). Here's a tip: Put a large piece of plastic underneath the engine to catch the fluids that don't make it to the pans. Then when you are done taking out the old motor just throw away the plastic. This way you floor stays clean and dry. The antifreeze will be pain in the ass because it will fill up the lower radiator basin, and come out through every little hole that is in it (there are quite a few).*

Fluids/Other items:
5W-30 Engine Oil, (4.5 Quarts)
Dextron III Automatic Transmission Fluid – *If needed*
Green Antifreeze or Dex-Cool
Hydraulic Power Steering Fluid – *If needed*
New Oil Filter
New Air Filter – *If needed*
Delco Platinum Spark Plugs – *If needed*
PCV Valve – *If needed*

Now these are the things that I used on my car, you can buy whatever brand you wish, and change what ever you want. But I though that I would start out with a fresh start to fresh motor. If something looks bad, worn, or broken, replace it! Don't risk all of your hard work because you did replace an Oil Filter!

You can change the spark plugs just for the sake of it being a lot simpler when the motor isn't in the engine bay.

You can use the Green Antifreeze if you want to. You *may* want to flush the engine to get out the Dex-Cool (orange colored anti-freeze) ~~because the two are not compatible~~, if you make that choice. I went with using Dex-Cool. If you do go with Dex-Cool, be sure to flush your cooling system first to get out most of the green stuff. Dex-Cool is rated to last 100,000 miles or 5 years, whichever comes first.

Note: Contrary to what some may say, you can indeed mix Dex-Cool and conventional coolant with no ill effects. However, if there is more than 10% of conventional coolant in the system this will reduce the concentration of the Carboxylate such that conventional coolants change intervals must be followed. In other words, if you mix it, you can't leave it in for 100,000 miles or 5 years, but instead should treat a mix just like conventional coolant and change it every year until the concentration of Dex-Cool is over 90%.

Quoted from: DEX-COOL Extended Life Anti-Freeze/Coolant.
By: Scott Mueller

I am going to use the engine out of a 2000 Grand Am GT (VIN E) (RPO Code: LA1) (207ci). It's not 'New', but a lot newer than my 3.1 with

165,000 miles. It has about 23K miles on it, which is just fine. I paid about $900 for the engine (which was a good deal years ago), and they come much, much cheaper than that now. When you are looking for the engine that you want, you have to be sure to ask about what is included with the motor that you are buying. Make sure of this, because if you don't, you will be paying for something that should have been included with the motor. You can this type of engine in more than a Grand Am, so keep an eye out if you're looking for one.

My 3400 engine came with a 4T45-E (MN5) transmission, so I had to remove it. You, on the other hand may not have to (That is if your engine didn't come with the transmission). In this guide, I will have the transmission from the 1995 Grand Am installed in place of the new transmission. The transmission from the '94 through '98's 4T60-E will bolt up exactly the same.

By using the 4T60-E you will not have to modify the drive axles any where. I'm not sure about the 4T65-E, but maybe it's worth looking into. But I assume that you have to have some custom axels made for the 4T65-E as well.

Some 3400's also come with some extra emissions crap on them. It's the *AIR System*. You can just remove all of that stuff and replace it with the normal parts.

If you have a 95 or older car, you will not have to use the MAF from the 3400. And you don't need any of the mounts, alternator, computer, wiring harness, or stock air box from the 3.4 for any other cars older than 1999.

3400 60° V6 Engines can be found in these Autos*:

1999-2004 Pontiac Grand Am
1999-2004 Olds Alero
1999-2004 Chevy Venture
1999-2004 Pontiac Montana
2001-2004 Pontiac Aztek
1999-2004 Olds Silhouette
2002-2004 Buick Rendezvous
2000-2004 Monte Carlo
2000-2004 Impala
1996-1998 Olds Silhouette
1996-1998 Pontiac Trans Sport/Montana
1996-1998 Chevy Lumina APV/Venture

**Current at the time I originally wrote this guide.*

Engine Removal

Well the old engine removal is not that hard, but it can be messy and frustrating, especially when parts break from being so rusty or worn. One of the first things that I did was to read the Chilton's auto repair guide. Just follow the book's list. The things that I found that were hard to remove were the heater core tubing and the exhaust (basically just the reach, I used an air ratchet to remove the bolts). Basically removing the engine is easy without the Chilton's at all, mostly common sense for most of it. Just be sure not to take out something that you didn't have to in the first place. This may seem silly, but clean the engine bay with the 3100 still in! Clean it real good, scrub everything you can. It makes the swap much easier. You should also clean the bay when the 3100 is out of it, it makes things real nice neat.

Despite the fact that you are certain that you've drained every last drop of every fluid out of the engine, the first titling motion will dislodge gallons of every conceivable fluid (Most likely anti-freeze). Plan for this and either pull the engine in a place where you can tolerate the spills, not where you are going to work under the car, or spread plastic sheeting under the car before actually pulling the engine. I kept the kitty liter close by to soak up any fluids that spilled. It works just as good as the expensive stuff.

Buy a package of Ziploc or plastic snack bags and a roll of masking tape or a small tablet. Group and label fasteners in the bags, and note any special features. For example, "Water pump fasteners - large bolt with stud goes in upper hole on driver's side". Put all the bags in a box to keep everything together. Label all wires and connectors. Make sketches or take Polaroid photos or videos during the disassembly process, then just stick the notes you made on paper into the baggie. In addition, having more than one of the same cars makes it very easy to figure out where something goes - you've got a full-scale model.

Parts To Save

There are a lot of parts to keep from the old 3.1L engine. These parts might replace some of the newer ones on the 3.4L engine. There may be some parts missing from your 3.4L, in that case, lots of the 3.1's parts will fit. I have made a list of what is needed to be kept from the 3.1L:

1. Motor Mounts (*Upper, Left Trans, Right Trans*)
2. Gas Lines
3. Engine Wiring Harness
4. Battery Wiring Harness
5. Engine Computer (ECU/PCM)
6. Transmission
7. Heating and Cooling Hoses
8. Alternator and Alternator Mounting Bracket
9. Timing Chain Cover/Water Pump **REVISED**
10. Belt
11. Harmonic Balancer (Crankshaft Pulley)
12. Knock Sensor/Oxygen Sensor
13. Crankshaft Position Sensor/Camshaft Position Sensor
14. Fuel Pump Switch/Oil Pressure Sender/Switch
15. Fuel Injection Harness/Fuel Injectors/Fuel Rail
16. Air Inlet Pipe, Filter Box, ect…
17. Oil Filter Adapter

I bought all new sensors from the dealership. This can be very expensive though. You don't have to but for to suppress any errors that might come-up; I would just have new ones installed. I will go in order of the above list point out what to do with these parts below.

1. Motor Mounts

No motor mount fabrication is necessary with this swap at all. If you have mounts that came with the 3.4, just take them off and put away. Put the bolts back in the holes where you took them out of. Now is a good time to buy new mounts or aftermarket mounts if the ones you have are not going to make it. More information on how to attach them to the 3.4 will be below.

3.1L Eng, Engine Mount - 22146738

3.1L Eng, Trans/Transaxle Mount – 22175102

2. Gas Lines

You must remove the nylon gas lines from the 3.1. Now what I mean is the fuel lines that connect to the fuel rail on the engine. The ones from a 99+ Grand Am 3.4 are in the wrong position and will not connect to the steel gas lines mounted to the left strut tower. So you have to remove the upper intake plenum (Note: You will have to remove it anyways to change it for the EGR and the Fuel Injector Harness). With the plenum off, you will see two gas lines coming off of the fuel rail. One is the Inlet line and one is the Outlet line. The Outlet line has a round bulge in it and connects to the Fuel Pressure Regulator. Also the return line (Steel ones located on the left strut tower) is larger than the fuel feed line.

Remove the newer nylon fuel lines from the 3400 rails and set aside. Remove the old nylon fuel lines from the 3.1 and re-install them onto the 3400 rails. You will have to wriggle them through to have them in the right spot. They need to be tightened to 15 lbs ft for the both of them.

Be sure not to install them crooked/cross threaded! You could have a gas leak if you did no matter how tight you make them!

There are 2 ways of going about this part:

1. Leave the nylon gas lines connected to the car and the fuel rails. Simply disconnect the fuel system from the 3100, and set aside. This is the easiest route but if you want to clean your fuel system follow the second part.

2. Some may not know how to remove the nylon fuel lines from the steel lines. You have to buy a Fuel Line Disconnect Tool in order to separate them from the steel lines. Just slip on and push out. Before you do this though, be sure to relive the pressure. To do this, locate the black plastic screw cover on the end of the back fuel rail. Take that off. Now there is a pin. Push that pin in, and be sure to have a towel underneath it too catch the spill. Now when you disconnect the nylon lines, gas IS going to come out no matter if you relived the fuel pressure or not. So be ready to catch it with old towels.

Here is a picture of the nylon fuel hoses installed on the 3400:

Inlet Pipe Location

Be sure not to forget to install the O-ring that goes onto the inlet pipe (towards the rear of the car on the fuel rail)! You will have a gas leak if you do! There is also a bracket that should be installed to hold the fuel lines in place, which you have to swap over from the 3100.

3. Engine Wiring Harness

Do not remove the harness from the car. Just remove it from the old engine assembly. You may want to clean-up any dirty connectors. I found that the Oil Level Sensor was pretty bad on most cars. Other than that, don't touch it. I would remove the harness from the 3400 if it came with one. Be sure to remember how the harness was on the 3.1! Mark all of the sensor locations on the harness using masking tape. You should also note where exactly the harness runs in the engine bay.

4. Battery Harness

If you got the battery harness that came with the 3.4 you can't use it. It's just too short. So instead you have to use the old one. One problem though, the hole on the cables will be too small to connect to the 3400's starter bolt. So all that you have to do is find a carbide drill bit that is a little bigger than the holes on the harness and drill them out. I am not sure about the size that you need.

Negative Battery Cable: 12157155 - $23.72
Positive Battery Cable: 12157410 - $57.66

5. Engine Computer (ECU/PCM)

You will need the 3100 ECU, **NOT** the 3400's computer. This subject is very complicated so I can't go much into it. 94 - 95 ECU's are ODBI½ basically. Actually I am almost 100% sure that all 94 - 95's are really OBDI, but they have a flash type chip, that's why they are considered OBDI½.

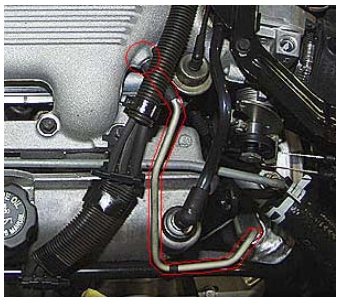
The 1994 to 1995 computer is on the left, and the '96 to '98 V6's OBDII is on the right. The 1996 -1998 has the same ECU connector as the 1999+.

6. Transmission

The transmission is a big question that everyone has on their minds. It really isn't that complicated of a thing. I just used the 4T60-E that came with the 3.1. I don't know what other applications will work as easily as this.

Will it work? Yes it will. There is **nothing** that you have to modify on the transmission to get it to work with the 3400. Neither of the drive axles will have to be modified nor the mounts that hold the transmission, because you never take it out. With the 4T45-E, the axles from the 95 will not work with it; the mounts will not fit with out modification. So don't even try is my advise.

The 4T60-E has a ventilation hook-up that the 4T45-E does not, which would pose another problem if you were to use it, but easily fixable with some extra hoses I guess. The pieces for this must also be saved. You also have to use the torque converter from the 3.1.



The Modulator Vacuum line on the 3.1.

Reinstalling the vent hoses is not hard and pretty self explanatory.

The Modulator Vacuum line will also have to be saved from the 3.1. Again, removal and installation of the part is very easy.

I'm guessing there will be a problem when installing a supercharger. The tubing will have to be moved to the rear of the Plenum. There is an extra outlet there. Then just switch the rubber cap around. More information on that installation may be followed up on in a later version.

The Transmission Cooler Lines will be kept also. Be sure to tighten each one to 16 lbs ft for each part they connect to. The lines are also a size 16mm.

Mounting the 4T60-E transmission is a piece of cake. Remove the 4T45-E (If equipped); put it aside and out of the way.

Transmission Bolt Placement.

Green: Normal Bolt *18mm Normal Size Socket*

Red: Double Sided Bolt (Stud) Used for ground cables from the harnesses. *18mm Deep Well Socket is required.*

Now the engine will have the flex plate and the torque converter on it. Remove the torque converter from the flex plate. Be sure to not lose those bolts, they're very short. Now remove the 4T60-E transmission from the 3.1. Then bring over to the 3400. Take the torque converter, and slide it onto the transmission (Use the torque converter from the 4T60-E transmission). You will have to turn it a bit to get it on to it. Remove the starter from the 3.4 FIRST! Now begin to move the transmission over to the motor. Be sure to have the flex plate bolt holes and the torque converter holes lined up so you can get to them! You won't be able to turn the torque converter when the transmission is close to the engine. Now get the transmission to but up against the engine as close as you can. There should be almost no gap between the two. Then bolt up the flex plate and the converter.

D*o not draw the torque converter to the flex plate, or you will damage the flywheel (flex plate) and torque converter.*

Once the bolt is in and to torque, you have to turn the crankshaft pulley so you can see the other bolt spot. I recommend having a friend help with this (Will be very hard to turn). After that, put the correct bolts in the places and tighten to 55 ft lbs each. That's about it to connect the two.

7. Heating and Cooling

You need to use the 3.1 radiator hoses. There are a total of 6 hoses that you use. Two of them are large and connect directly to the radiator. The other ones connect the coolant surge tank to the engine and the last 2 are heater core hoses. It's pretty straight forward on how you hook them up.

The heater core hose pipes on the 3400 have moved up on the engine. So what you do is use one of the hoses from the 99+ Grand Am's and on from the 95 Grand Am. Getting the clamps on and off of the hoses is big challenge. The left side (Drivers side) is the *Outlet*, and the right side is the *Inlet* to the heater core. Don't try to disconnect the tubing from the firewall with the engine still in the compartment. It will be very hard if you do, and the tubing ends on the heater core are plastic and have a high risk of snapping off (Very, very bad if you do this!).

Just disconnect them from the motor, and remove if necessary later. The hard part will be the removal of them, but this depends on the condition of your car too. The pipes over time may, and most likely, will have begun to rust from the antifreeze, so this rust that has formed in the piping will bond the rubber hose to the metal pipe.

What you do is get a pair of pliers and twist the rubber hose around a few times to loosen it. Then pull off. Coolant will spill out.

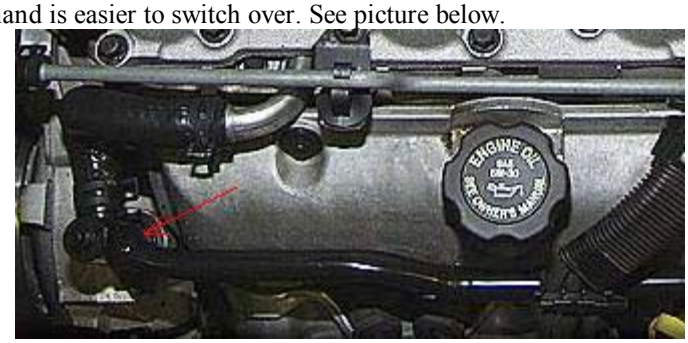
One way (The best way) to use the older coolant line pipes is to have the lower manifold taped so you can screw in the old pipe, since the newer one is the push on type. The size of the tap that you would need is 1/2 inch NPT. Just go about ¾ of the way down into the hole. Below is the part that screws into the newly taped hole.

A/C Delco PN #6047166

3400's Push-On Type

I just left it and installed my own type of tubing that I bought at an auto-parts store, which isn't that hard to install. If you go this way, you will have the pipe bent a bit in order to get the transmission dipstick to get by it. Do not bend the tube while it is in the manifold!! You will damage the manifold since its aluminum! Take out the pipe and bend it in a vise. You will also want to remove the plastic end connector on it to allow more room. You might also be able to cut-off some of the tubing to allow more room (Not really necessary though). Be sure to also make sure that the bolt that holds the pipe in place is secured very tightly! Or else the pressure from the coolant will push it out.

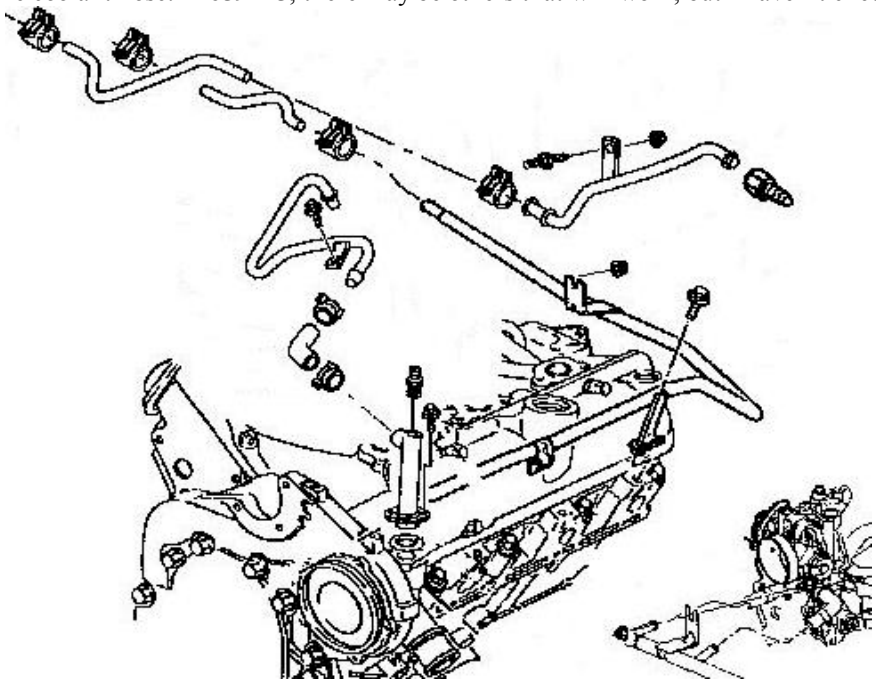
The other pipe, (The one that sits right in front of the front valve cover and goes into the water pump) on the other hand is easier to switch over. See picture below.



You may have to remove the side exhaust manifold to be able to get the pipe through. There are a couple of options that you have with this involving the heated throttle body that the 3400 comes with. **Option #1**: *94-95* 3.1's do not have heated throttle bodies. So what you will have to do is pull the rubber hoses off of the TB and just don't connect them. **Option #2**: *96-98* 3.1's DO have a heated TB connection on the pipe (and are shaped the same as the 94 and 95's piping), thus allowing a heated TB. Either way is your call.

V6 THROTTLE BODY (1994 - 1995) (Non-Heated) - **17094010**
V6 THROTTLE BODY (1996 - 1998) (Heated) – **17096152**
V6 THROTTLE BODY (1999+) (Heated) – **17113543***

To sum it up, the heater core hoses are a pain in the ass. There are many things that you can do to make it work, so I won't go into detail on everything that you could do. You can just use a factory hose from a 99+ Grand Am, and it should work fine. Just watch out for the steering mechanism. Here is the part number for the coolant hose: **22659275**, there may be others that will work, but I haven't checked.



You may also want to install a lower temp thermostat (180°) while you have the motor out of the car and the coolant drained. You can get one from PFYC.com for about $11. It's very easy to install.

Dex-cool Coolant GM Part Number: **12346290** (one gallon)

Mixture (coolant/water) Freeze Point Boil Point:
50/50 -34 deg F 265 deg F
60/40 -62 deg F 270 deg F
70/30 -84 deg F 276 deg F

Another note on the heater core hoses: I found that instead of using the factory 'pinch' hose clamps that are provided, I used the screw driven Hose Clamps. These hold much better, and the most important part: are a much, much easier to remove or install.

Mixtures of less than 50% coolant or more than 70% coolant are not recommended.

**Note: 3.4L V6; all others are the 3.1L V6.*

8. Alternator

You will not have to use the newer alternator form the 3400, you can use the 3100's instead. Installation of the old alternator to the 3400 is easy. There is four basic parts that are used: the alternator, alternator bracket, engine mount bracket, and the bolts. Be sure to get the bolts really tight since there's less support for the alternator.

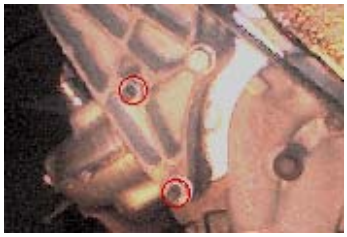
Alternator Bracket

There are a few parts that you will not use, two mounting brackets. They are tubular and black colored. These won't work with the upper plenum; there is no mounting hole for them any longer with the 3400 heads. There is one that could be installed if shortened I suppose, but it might not work if cut. Something to check for later…

Also when swapping over the alternator, you will have to switch over the engine lift bracket. The newer one will not fit with the '94 - '95 alternator bracket. I used medium sized grip pliers to grab onto the very inside of the black bolts (Closest to the motor) that hold the bracket. This way is a very simple way of removing those tricky bolts. Just do the same to install them. Not very professional, but it gets the job done.

In the picture I forgot an engine mount bracket that is attached to the alternator bracket.

This is the mount bracket that attaches to the alternator bracket.

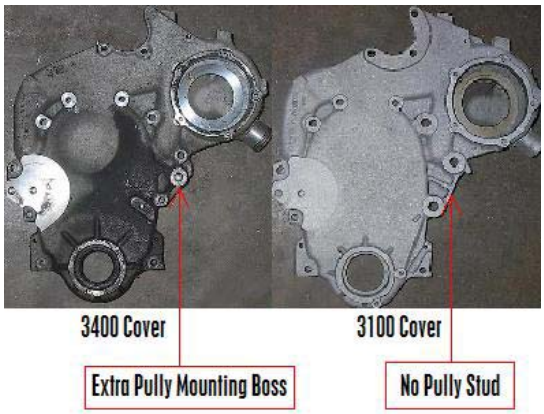


For easier removal/installation, use large pliers on these two bolts.

Alternator Harness Connector

9. Timing Chain Cover/Water Pump

The 3400 cover itself is the exact same as the 3100, but with one difference. There is an extra 2 pulleys that the 3400 uses. This intern adds an extra knob to the cover. One way to over come the extra stud is to simply cut it off.



3100 Timing Chain Cover w/Extra Knob Location Pointed Out

The best thing to do at this point for most people is to just leave the 3400 cover on, and simply cut off the extruding stud. This way you will no messing around with gaskets and stuff. This also reduces the chance of creating an oil leak (very bad, very messy).

10. Belt

Save your old belt. Or buy a new one, which ever you like. No special size needed, just the regular 3.1 serpentine belt is all.

Specs - 68.5 inches; 6 ribbed
Belt - Serpentine Drive
Part Number: 6K685 *(AC Delco Part Number)*

Serpentine Belt Tensioner: If your engine has high miles, I would say over 100K, you should replace the belt tensioner, or the bearing in it. It more than likely will fail when it has high mileage on it. This is a FYI, so change if you would like to. You should be able to use the 3400's, but I'm not totally sure on that. Here is a tip for getting the belt on easier when all the accessories are installed and the engine is in the car: You *have to* go through the bottom to get to it. Find a long 19mm open end wrench. The open end will fit onto the end of the pulley. Pull up on the wrench all the way to get the belt back on to the alternator pulley. Easy!

11. Harmonic Balancer (Crankshaft Pulley)

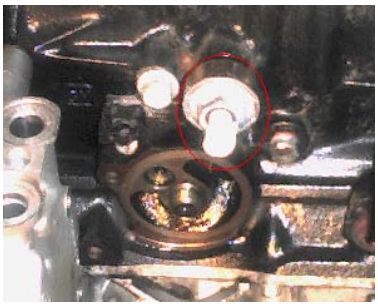
You can swap over the old harmonic balancer pulley or just use the newer one. I don't know if there's a difference. I used the 3.1's though, so I couldn't tell you if there is a difference between the two. Use a size 28mm air ratchet socket, do not use a regular chrome socket or else it will shatter on you! You should use an air racket to loosen and tighten the bolt, since the motor will want to crank on you when you use a bar. Be sure to also grease up the bolts on the pulley puller when you remove the pulley. Tighten it to 110 ft lbs

Balancer: **#24504609**

Do NOT to bend the interrupter ring on the inside of the pulley, or you can damage the sensor, and it will cause a rough idle or no start.

12. Knock Sensor/Oxygen Sensor

Knock Sensor (3400)



Location; Above oil filter

Just swap over the one from the 3.1, or replace it with a new one. Make sure that the threads are clean also. Tighten the sensor to 12-16 ft lbs. Note that there is a difference in connectors between the 3400 and the 3.1's:

The 3100 is on the Left and the 3400 is on the right.

You have to swap over the oxygen sensor because the connections are different between the two. Removal from the 3.1 will require an Oxygen Sensor Socket, but the removal/installation from/to the 3400 will only require a wrench. Tighten the sensor to 30 ft lbs.

3100's O_2 Sensor

3100 / 3400 - Male O_2 Connector

A little note on the SES Code 43 (In case this comes up): Loss of ground at the ESC (Electronic Spark Control), failure or loss of the ESC signal to the ECM will all set code 43. Loss of the ESC signal will cause the ECM to constantly retard timing, resulting in sluggish performance. So if your car doesn't have any oomph, this may be your problem (or at least something to check first).

Do Not Over Tighten Either Of These Sensors!

13. Crankshaft Position Sensor/Camshaft Position Sensor

Again, same as above, just unscrew the 3400 sensors, and replace with 3.1 or new ones. As for the camshaft position sensor, it's just as easy to change.

24x Sensor: Bolted to the front side of the timing chain cover and is located partially behind the crankshaft pulley.

Location, Bottom of Timing Chain Cover

24x Sensor

3x Sensor: Is located behind the engine, right below the exhaust manifold. Just unscrew the retaining bolt, pull out the 3400 one, and replace the sensor. If you have a new one, lubricate the O-Ring on first with motor oil. Then tight the bolt down to 71 inch lbs. This sensor runs directly to the distributor coils. Make sure it doesn't lay across the manifold or exhaust piping! Tie it away.

Location, Back of motor

3x Sensor

Camshaft Position Sensor: You will have to remove the power steering pump in order to reach it. Take out the screw, and pull it out. It might be a little hard to get out at first because of the O-Ring. Then just clean up the area (Don't get anything into the hole!), and replace it with the other sensor (Part #**24508215**).

Camshaft Position Sensor

14. Fuel Pump Switch/Oil Pressure Sender/Switch

There are two kinds of oil pressure switches that can be used. They both depend on the cluster (Dash) that you have in your car. Some cars have Tachometers some don't.

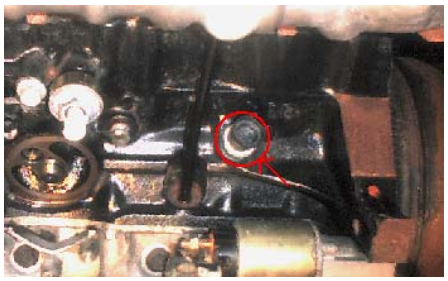
You can tell the difference between the two by how long they are. Here is picture of the two:

w/ Gauge Cluster Left; w/o Gauge Cluster Right

Connector; Equipped w/ Oil Pressure Gauge

Connector; No Oil Pressure Gauge

The installation of the Oil Switch is not hard at all. All that you need is a crescent wrench to loosen it. Then finish by removing by hand. Here is a picture of the location of the part:



15. Fuel Injector Harness/Fuel Injectors/Fuel Rail

You will not need to keep the 3400's harness, injectors, rails, or regulator. The Fuel injectors on the 3400 have a different connector than the 3.1. So you have to switch the injectors.

The 3.1 fuel injector connector is on the left and the 2000+ 3400 fuel injector is on the right. Swapping over the 3.1's fuel rail and injectors is highly recommended. This way you don't have to modify your harness that you may want to use later if you upgrade your injectors to something else. A note about the injector harnesses: The 3400 manifold harness has the Engine Coolant Sensor, Map Sensor, Fuel Injectors, and the Camshaft Position Sensor on it. The 3.1 doesn't have the Camshaft Position Sensor in it. So it has total of 10 Bulkhead (Black Connector) wires and 2 other wires (ECT Sensor [White/Blue Connector]) for a total of 12. The 3400 harness has 14 wires. This gives the harness two extra wires and a different connector head, so that makes them incompatible. The 3.1 is on the left and the 3400 is on the right:

Fuel Injector Harness Bulkhead Connector

Here's what to do if you don't want to switch over the fuel rails or injectors: ***(Not recommended!!)*** Cut off the 3.1 fuel injector connectors. Be sure to give your self the right amount of wire to be able to work with (about an inch or so will do). Then cut off the injector connectors from the 3400 harness. Re-attach the 3.4 injector connectors to the 3.1 harness. Just match-up the colors if you don't know which ones go where. You won't have to do anything to the coolant sensor connector.

16. Air Inlet Piping, Filter Box, ect…

Most of you will want to use a K&N filter or some other aftermarket filter, which will work just great. But if you want to use the stock air box, it will work exactly the same. You can also use the 3400 rubber intake tubing (it has a slightly larger diameter than the 3100's). The Air Temp Sensor (See Below for more info) is located on the opposite side, but that doesn't really matter. It is a little bit shorter than the 3100's, but it will reach just fine. It's just something to look into.

17. Oil Filter Adapter

You may notice when you try to switch over the adapter, that there is a screw for an oil filter that is in the way of getting the adapter installed. Be sure to replace the gasket that sits between the OFA and the engine block to prevent a leak.

Well this has a simple solution: all that you have to do is get a hex driver (can't remember the size) and stick it in the hole of the oil filter screw. Unscrew, and then the oil filter adapter will fit on it exactly like the 3.1. Be sure to spread a little bit of oil around the gasket of the adapter, just like you would on the oil filter itself. And don't forget to do it to the oil filter too. Be sure to get the bolt in there nice and tight.

Oil Filter Adapter Gasket (GM): #12337894

Other Stuff:

Coolant Gauge

Most new GM models of cars are now using 1 temp sending unit on their cars now. So because of this, you will run into a little problem when installing your 3400 into your car, since they use 2 separate sensors to get the coolant temp. Here is the fix:

Upon further inspection of the 3400, you will notice that there is no place for one of the temperature sensors. This is the one with an only one dark green wire coming out of it. This sensor sends a signal to the dash to show what the temperature is.

Dash Coolant Temp Sensor

Sensor Connector

Engine Harness Connector

ECT Sensor: 1 Blade Terminal: **25036807**
AC Delco Part Number: **10232601**

I suppose if you had the tools and skill, you could just tap out another spot on the 3400 heads for that sensor. The size of the hole that you have to make is a 1/2"-14, using a tapered pipe tap. Or just use the heads from the 3.1, but that really defeats the purpose of the 3400 swap (and would be a lot more involved). The computer uses this sensor:

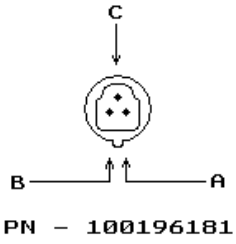
ECT Sensor: 2 Blade Terminal **#12146312**

Sensor Location

Don't mistake the Low Coolant Sensor that is located on the coolant surge tank for the temperature sensor, because they have close colors to each other.

The other, and most common, thing to do is to buy the 3-blade (connector) ECT sensor. This sensor features a 3-wire set-up. It's a matter of matching up the colored wires, to the correct pins on the sensor.

New Connector you need



ECT Sensor: **#10096181**
3-Blade Connector: **A/C Delco PN #PT375**

Installation:

You will need a deep well socket size 19mm to get the sensor out, and to install it.

- Remove the air box assembly

- Remove the throttle body
- Un-hook the connector from the sensor
- Using the deep well socket, remove the sensor. There will be some coolant that spills out, but not a lot, so just wipe up the mess.
- Install the sensor
- Now to hook-up the sensor, you will have to visit a junkyard and get the correct 3-pin connector. It's the same connector that is used on the throttle position sensor. Check out the diagram for the sensor for the pin locations

Pin A = Black, PCM Sensor GROUND
Pin B = Yellow, Coolant Signal to PCM
Pin C = Dark Green, To Dash

- Splice into the correct wires
- All done!

After Installing:

Now one thing that you may have noticed when you have the sensor installed, and have had the car running for a good amount of time (to get it to normal operating temp), is that the temp on your dash reads *different* than it did before! What's going on you ask? Is the sensor faulty, or did I give you some bad info? Nope. If there is a problem with the temp gauge at all, it is certainly not that it is inaccurate. The gauge is perfectly accurate (well I assume it would be...), but the *sending unit* for the dash is mounted in the wrong place to get a 'correct' reading. Unfortunately there are no other tapped holes in the heads to mount it, unless you tap them yourself. It should be good enough to give you an accurate reading anyways.

Air-conditioning:

You can keep the air conditioning system in your car also. Just swap over the old compressor from the 3.1. They will bolt-up exactly the same. The reason you can't use the compressor from the 3400 is because the hoses will not be able to connect to the compressors newer hose connections and the electrical connector is different. This won't affect the belt at all either (Both the 3100 and the 3400 compressors).

This is how to keep the refrigerant in your car's system: Remove the A/C compressor lower mounting bolts and remove the compressor from the mounting bracket and position aside. Do NOT disconnect the refrigerant lines from the compressor or allow the lines top support the weight of the compressor. Just use a long piece of wire to hold it.

If your compressor is shot, here is a price of a new one from the dealership (There might be a core charge, not sure though):

The A/C Compressor from the 3400 will not work with the 95's system, so don't try. There a couple of problems that you will run into if you don't hook-up the A/C or disconnect it. One: The Computer will light-up the SES light on your dash. Two: The computer will think that the A/C pressure is too high, that intern will make the Engine Cooling Fan run all of the time, no matter what the temperature is outside, or how hot your engine is. This may be good for keeping your engine cool, but it's annoying.

The SES Code that your computer will throw out is: "70: *A/C Pressure Sensor High"*

EGR:

Believe it or not, this is one of the little problems for this swap. Everyone has questions about it and here are a few answers.

You will, depending on the year of the engine used, have to find/buy another Upper Intake Manifold (UIM). The reason for this is so that you can use the Digital EGR (DEGR) with the 3.4. I believe that you have to use the manifold from a 1997 3400 engine. This type of engine will be found in a Pontiac Transport, Chevy Venture Minivan, or Oldsmobile Sihlouette. The EGR will make the mounting to it a little easier. The plenum from a 99+ 3.4 will not work because the mounting plate for the EGR has changed to a vertical style. They switched the mounting style completely. The 97 manifold will bolt directly to the lower manifold.

You might want to retain the digital EGR so that the computer doesn't throw a code, and it can be modified to work with the 3400 just fine. It's for emissions and some fuel economy. Now the big problem with keeping the 3400's EGR is the EGR solenoid, as the 3400 uses a linear type rather than digital. The EGR functions will have to be disabled in the PCM's code if you don't want the EGR to be used, otherwise the system will attempt to activate the valve at ~20 sec intervals during cruise speeds, and a surging condition will result. This valve test (activate/fail sequence) will occur even if the valve is

mechanically blocked off and not hooked up electrically (Which I did). I found that the code comes one after you have been going above 60 or 65 mph (or give it WOT or close to it) and slow down or come to stop. It doesn't effect how the car runs at all.

So what I did as a temporary set-up, until I either disable the code or make a plate, was find a flat piece of aluminum (about 3mm thick, the thicker the better), cut it (for a cleaner look, and to get it to fit), and drill holes for the two bolts, and use a high temp sealer (Found at any auto parts store) to mount it to the plenum, then plugged the exhaust hole on the manifold. One way to accomplish this is to take the old EGR exhaust tube that comes from that hole and cut off the top of it, leaving 2 inches left on the pipe. Then hammer down the pipe so it's nice and flat (Make sure that there's NO way any exhaust gases can escape. Then cut off the sharp ends. I just left the EGR connector off and tied off to the side. This may seem weird, but it works. It didn't seem to affect the engine very much. So basically you could do this with the vertical style EGR mounting also, but it would make using or making an adapter for the EGR later harder.

Another route that you can follow is to do nothing at all with the EGR. Just leave in on and do not touch it at all, and don't connect it to the harness (because you can't anyways). This seems to be a temporary way of dealing with the EGR, and recommended if you don't want more work than needed. But by doing this, you will have to have the code disabled or hope that the computer doesn't throw a code (which probably it will)

Having the EGR not working *may* be to your advantage. By not having the exhaust gases re-enter the intake, it will stay nice a clean and not clogged with exhaust guck. This also will allow fresher, cooler air, possibly resulting in more power. But on the other hand, the EGR valve is there to cool down your engine and for emissions. I'm going to go into detail on this but you can look it up on the internet some place to find out more information.

The newer 99+ style are on the left (Vertical Mounting), and the kind that the Digital EGR uses is Horizontal mounted.

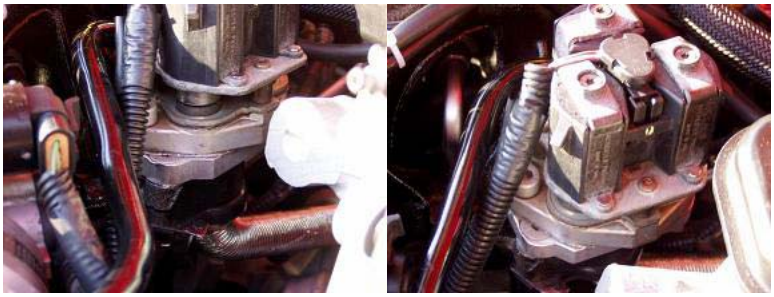
Digital EGR Connector / Linear EGR Connector

For the adapter shown here, you must, switch the UIM over to the older 3400 EGR mounting style found on minivans. What you have to do is buy the adapter, or make one yourself. Then you have to purchase 3 EGR gaskets for the installation. Keep in mind this is only for people under the years of 1996. The guy I bought mine from included the plate, bolts, and instructions. The adapter I bought is of very excellent quality. It's a high grade aluminum plate, and the bolts have hex-type heads for high strength and good looks.

EGR Adapter Plate.

-Visit ***http://www.60degreev6.com/store/*** *to order this adapter! -*

These are the 3 EGR gaskets that you will have to purchase. They are very inexpensive.
Here is the years & part numbers *(A/C Delco)* for the gaskets (Going left to right according to the pictures):
1996 - **219-182**; *1996* - **219-183**; *1995* - **24503788**



This is the final result. Very professional, and works perfectly. **This is must have!**

MAP Sensor: The MAP sensor is the same for the 3.1 and the 3.4 so the MAP sensor should not have to be changed, but they do have different part numbers. I changed mine after I had the car running, but it doesn't seem to make any difference of which one is connected. The mounting is the same also between the two.

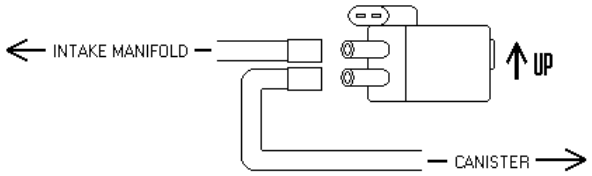
MAP sensor

MAP Sensor Location

MAP Sensor - **16137039**
MAP Sensor (3400) - **16254719**

EVAP System: The EVAP Purge Solenoid Valve will have to be relocated to where it was originally on the 3.1. It will be a smooth change over. Be careful when handling the solenoid though, the hose connector tabs can break off very easily. Since there's no EVAP Solenoid Bracket on the lower Ignition Coil bolts on the newer cars, they put a washer in place to hold the coil packs up. So what I did was to just cut the washer off. This can be a pain in the ass since they like to spin (and are very strong), so I just put a vise-grip on them and used a carbide drill bit, or you can use a dermal drill with disc cutter. You also could just swap over the old bolts, but that's a bigger pain in the ass, and takes more time. Either way is up to you.

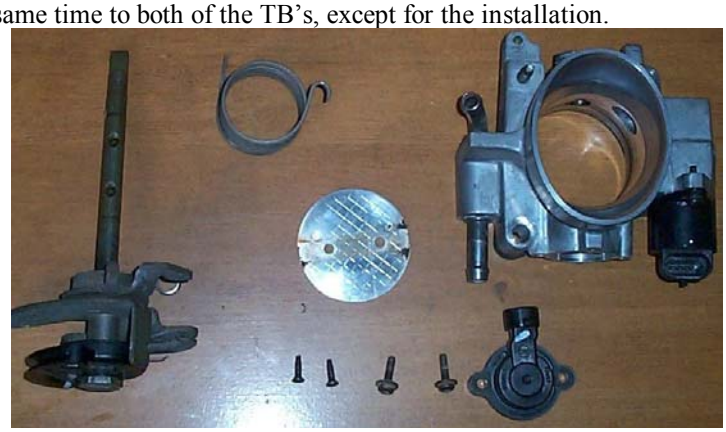
The tube from the crankcase connects into the upper tab and the lower tab goes to the EVAP canister. See below for picture.



Accelerator and Cruise cables: I just used the 3400 intake instead of the 3.1, just because the 3.1 is a little smaller (56mm vs. 52mm). The cruise control cable will not be able to connect to the 3400 TB properly though if not modified. The accelerator pedal will work just fine with the 3400 TB. One way to solve the problem with the cruise is to swap the parts from each other (Described Below), or buy a 62mm TB and switch over the parts, which will be a better investment anyways. You also have to change over the bracket that holds the cables in place. The 3400 bracket has too big of a slot for the cable ends to sit in.

Cable slots are too large for the 95's

<u>*Throttle Bodies*</u>: You are going to want to keep the 3400's TB, but the cables won't connect, like I mentioned before. But changing over the parts is very easy and only takes a couple of minutes. Do these instructions at the same time to both of the TB's, except for the installation.



The TB Parts that are needed.

Step 1: Remove both TB's from engines.

Step 2: Remove the Throttle Position Sensor; it's the 3-wire connector if you're not sure. The screws are a size T-25 Torx bit.

Step 3: Remove the plate inside of the TB using a size T-15 Torx bit. The plate will then slide out.

Step 4: Using a hammer, lightly tap the end of the shaft that was inside of the TPS until you can pull the rod out by hand. Be careful though, the spring will recoil and it may snap your fingers when the shaft is moved.

Step 5: Clean the pieces that you removed, you don't want any loose stuff in your engine. I found that swab-type metal polisher works really well.

Step 6: Now its time to assemble the new TB. Place the old spring onto the shaft. Don't use the new spring, its shorter and I believe that it has too much tension.

Step 7: Place the shaft back into the man TB assembly.

Step 8: Put 3400 TB plate into the shaft. Make sure that the port can be fully closed by its self, do not force it. If it doesn't seem like it fits, then it's in wrong. After it's in correctly, put the smaller screws back into it.

Step 9: Place the 3100 TPS sensor and/or the IAT valve back onto the TB. (Not sure if it makes a difference if you don't switch over the 3100's, I didn't notice any change when I did)

Step 10: Make sure that the TB works correctly by using your hand to turn it. If everything is fine, then re-install it onto the engine.

Now you will be able to have cruise control, and a correctly mounted accelerator cable. The 3400 TB is 56mm vs. 52mm from the 3100. It's not that much more, but still larger than the 3100's, so you will get a slight increase in flow due to that. Increased air flow is a good thing.

Completed TB swap on your 3400

Throttle Body Gasket (3400):
'00 and Newer: #24506945
'99 and Older: #24504016

Exhaust Manifolds: If your 3400 didn't come with any exhaust manifolds, the 3100's should fit. I would use the 3400 ones though; they are larger than the 3.1's from what I've heard. When you use the 3400's manifolds, you will have to have the exhaust down pipe from a 3400 in order for you to be able to connect it to your 94 or 95's current exhaust system. The only way that you can connect the 3400 to the 94 or 95's exhaust system is to have it brought in to an exhaust shop. The 3400's exhaust sits farther to the right (passenger side firewall) than the 3100's. This means you have to have a custom pipe bent in order to have it work (Most likely not a at home project). There will be a tight squeeze between the firewall and the pipe, but it will fit. Basically all that the exhaust shop needs is the head of the down pipe. They won't be able to use 3100's down piping because it has a dual layer design (which is not worth even trying to make work, since it will be a lot cheaper to have a new pipe put in instead.).

Starter: If your 3400 came with a starter that is very good. If not, the old will work with no modification. Even though I would stick the 3400 starter because of the smaller size and it's a little lighter, and more reliable from what I hear.

(99+ 3.4 V6) – 10465459

Fuel Injectors: The 3400 will *run** with the 3400 fuel injectors, but the 3100 are recommended. This way there is no modifying of the fuel injector harness. From what I understand you are going to want to keep that fuel injection harness from the 3.1 anyways. For an improvement for ride, starting, and performance, the 3100's fuel injectors are recommended. *You will need new O-rings on them.*

Fuel Injector O-ring Kit: A/C Delco PN # **217-1379**

These are the specs on the Fuel Injectors (May not be entirely accurate):
94 - 95 3100's: 17#
Pre-00 3400's: 19#
00+ 3400's: 22.5#

When you swap in the fuels and injectors, also use the FPR from the 3100 rail as well.

3100 Stock FPR

Notice: When connecting the fuel rail lines back up to the fuel rails, be sure to have the necessary o-ring on the piping! Or you will leak gasoline onto your engine! See below:

* *It will run, but not at optimal. Your ECU isn't set for the higher fuel flow rating.*

Engine Oil Level Sensor: Should not have to be changed, since the part numbers match. Just make sure that the area is clean before plugging in. The spot can collect oil and dirt very easily.

(3.1L V6) – **24506885**
(3.4L V6) – **24506885**

Connector (Black w/Gray Weather Seal)

Fly Wheel (Flex Plate): This should not have to be changed, since the part numbers match up. Do not damage the teeth when changing in the motor.

(3.1L V6) – **24576876**
(3.4L V6) – **24576876**

Ignition Systems: I changed my ignition module over to the 3.1's after the swap was done. So the 3.4's coils and module will work regardless. It's up to you what you want to do.

Ignition Coil:
(3.1L V6) - **10472401**
(3.4L V6) - **10472401**
Ignition Module:
(3.1L V6) - **10489422**
(3.4L V6) - **10489422**

Air Temp Sensor: Don't change. The 3400's is a little shorter than the 3100's if you can't tell the difference. And the '96 – 98's are located on the Air Filter box.

Do not touch the inside of the sensor, you may damage it!

(3.1L, 3.4L V6) – **12160244**

'96 – '98 Air Temp Sensor

Other Notes

Now there are a lot of parts from the 1996+ 3100's that will work with the 3400 that you are swapping in. I have listed a few here, but defiantly not every thing. I will make a type of cross reference chart and another manual for them later. Some of them would be really helpful for keeping that 'from the factory' look, which I strive for on this swap. Some also may make the swap a tad easier.

Finishing Up

When installing the wheels back on, the wheel nut torque is 100 ft lbs.

Before starting-up the car for the first time, you will want to make sure that you have done every thing correctly. I have made a checklist before you start the car.

1. Check *every* electrical connection.
2. Before adding fluids, make sure that all hoses are properly connected and secured to there places tightly.
3. Make sure that all of the bolts are to the proper torque, and that none are missing, and do not use a weaker bolt in place of a stronger bolt.
4. Check all of the fluids for proper levels. This might not be possible until you get the engine running for some of them.
5. Make sure you have gas that hasn't sat too long.
6. Check the ground wires and/or clean the ground wire connections with a wire brush.
7. Make sure that no tools or rags are lying in the engine compartment.
8. Check the battery (if necessary).
9. Check all of the vacuum lines.
10. Check the EVAP system, and that all of the piping/tubing is connected.

Now time to give your car a test run. If you don't have any exhaust hooked up, it will be very loud! So beware! There may be white smoke from the motor sitting so long, but that's fine. When car is running be sure to check for leaks (Vacuum or Fluid). If a no go, check everything again. Be sure to bleed the power steering system after the vehicle is running (If necessary). Then check the levels of the fluids again. Don't be rough or hard on the car for a while to make sure everything works fine. Don't accelerate hard, or rev it excessively. The car will run a little lean until you re-connect the exhaust so don't worry.

You Have Problems?

I will cover a few things that might come up after the engine is in and running or lack of running right. Not every possible thing that can go wrong is listed here; this is just for some reference. More than likely, your problem will not be listed here, so you will have to do your own homework on that. **Not really complete**

Bad Idle:

IAC Valve: It's possible that the IAC valve has carbon on it and messing up the idle. If you want to clean up the intakes and valves and combustion chamber of the carbon, check out 60degreev6.com for instructions how to. If that doesn't help, I would take the IAC off (2 Torx bolts, size T25) and spray some carburetor spray inside there. Also spray the tip and get the carbon off of it. You can also try the Idle re-learn (Located below).

No Start / Runs Badly:

One possibility is the crankshaft position sensor. If the interrupter ring on the inside of the crankshaft pulley is bend or dented, even a little, it will cause some problems. Make sure that the sensor is plugged in, and it has the correct part number.

Like I mentioned above, check the vacuum lines. You may be able to hear a hissing nose or a high pitched whine if they are not hooked up. Not having the correct vacuum can cause the engine to run badly.

Also make sure the Ignition Coils are fully plugged in and the spark plug wires are correctly connected and firmly pushed onto the coil packs/spark plugs.

Idle Relearn:

By: sappyse107 (Ben Phelps)

There are a few methods floating around, but this is the one used by GM techs.

Reset ECM by pulling ECM fuse (under hood) for a few seconds.
With A/C turned off, start car and immediately put it in Drive with your foot on the brake. If the car does not start initially, keep trying WITHOUT putting your foot on the accelerator.
Let the car idle in gear for at least 5 and no more than 7 minutes.

Shut off the car for 10 seconds.
Start engine, place in drive and let idle for 5 minutes.
Shut off engine.
Idle is learned.

I am not really sure if you need to do this, but I added it in to do, sort of a FYI (This can be originally found at ***www.60degreeV6.com***). I found that it did make my car run a smoother in idle. Then after that and every thing goes fine, put the hood back on with the help from a friend, bring her to a muffler shop and have them hook up the exhaust. You could use the down pipe from a 3400 or if you used the 3.1 exhaust manifolds *(faster way)*, then just hook it up your self. It will be cheap any way you do it.

Part Numbers

Upper Intake Manifold [Horizontal EGR Mount] - **24508396**
Timing Chain Cover Gasket - **10189276**
Oil Pressure Switch - **12555492**
Camshaft Position Sensor - **24508215**
7x Crankshaft Position Sensor – **10456555**
24x Crankshaft Position Sensor - **12567648**
Knock Sensor - **10456208**
Heated Oxygen Sensor - **25312184**
Evap Purge Solenoid Valve - **1997201**
Evap Purge Solenoid Valve Bracket - **10223631**
Transmission Cooler Line (Lower) - **22651564**
Transmission Cooler Line (Upper) - **22651565**
AC/Delco Oil Filter - **PF47**
Thermostat - **24507563**
AC/Delco Platinum Spark Plugs - **41-940**
AC/Delco Fuel Filter - **25121293/AC Type GF-578**
PCV Valve - **CV-892C – 25043843**

I recommend is going to this web site: http://www.gmpartdirect.com. I recommend that you know the part number that you are looking for, or else you may not find it. When you get the new parts at your house, check the part numbers from the new parts with the ones on the old parts, just to be sure they match.

A few approximant fluid amounts for your information:
Dextron III Automatic Transmission Fluid - 6 or more quarts (Sometimes a little more is required)
Antifreeze - About 13 – 13.5 quarts
Power Steering Fluid - 2.25 pints (For complete system)
5W-30 Engine Oil - 4.5 quarts
Add more or less as needed.

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My cousin Steve
www.60degreev6.com (Also for hosting my guide)
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All of the Grand Am Sites/Forums
McGavin Auto Sports Web Page
UGAP - UsedGrandAmParts.com
Chilton's Repair Manual
Scott Mueller – For Some Text