P/N 60219 & 60220
2000 - 2002 GM VORTEC THROTTLE BY WIRE FUEL INJECTION 4.8L, 5.3L & 6.0L WIRE HARNESS INSTALLATION INSTRUCTIONS

Manual P/N 90559

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1.0 INTRODUCTION

You have purchased what we at Painless Performance Products believe to be the most up-to-date and easiest-to-install automotive fuel injection harness on the market. It is designed for easy installation, even if you have no electrical experience.

This harness is designed to be a complete wiring system for the fuel injection system on General Motors 2000 - 2002 4.8L, 5.3L, & 6.0L Electronic Throttle, also known as Throttle By Wire or Fly By Wire, Vortec injected engines and to control the 4L60E, 4L65E, 4L80E, 4L85E automatic transmissions using the computer Service #12200411. This includes all wiring that is needed by the computer to run and control the injection system and transmission.

NOTE: This harness is not emissions legal unless used with emission harness #60328 or 60329. Also, the computer's program must match the emissions package to that specific engine.

To overcome the Passlock system in the 12200411 programming, the PCM will need to have this feature removed. Contact the Painless Performance Tech Dept. for information on PCM programming. This harness along with the removal of the Passlock software will get the Vortec engine and transmission up and operating but it is recommended that you also have the computer reprogrammed to remove anything in the original factory programming that relates to a device or devices that are not being used in your particular vehicle.

NOTE: This harness has no provision for operating cooling fans. If you wish to operate the fans automatically, painless kit #30106 is available. This kit will turn the fans on at 205 degrees, and off at 195. This kit is also available in a weatherproof version, part # 30127

NOTE: Most likely the check engine light will come on and stay on when using a computer without removing the programming for any unused devises.

NOTE: Most remanufactured computers come without any programming in them and must be programmed before they can be used.

NOTE: The program in your computer must match the transmission that you plan on using, the 4L60E, 4L65E, 4L80E, or 4L85E.

Usually the computer, relays and fuse block can easily be mounted under the dash. Most of the wiring in the harness has been pre-terminated to the proper connector and all wire has been GM color-coded. All wiring is TXL, 600 volt, and 125 degree centigrade with cross-link insulation.

This fuel injection system harness has been divided into three major groups:

ENGINE GROUP	Includes wiring for the fuel injectors, ignition & charging systems, power/ ground and sensors.
DASH GROUP	Includes wiring for the ignition feed, assembly line diagnostic link (DLC) connector, check engine light, computer connectors, brake switch, tachometer, electric speedometer, fuse block, fuel pump relay connector and emissions devises.
TAIL GROUP	Include wiring for the VSS, park neutral position sensor, transmission and power wire for fuel pump.

2.0 ABOUT THESE INSTRUCTIONS

These instructions provide information for the installation of the 60219 & 60220 TBW Vortec Fuel Injection Harness Kit. The contents of these instructions are divided into major **Sections**, as follows:

1.0 INTRODUCTION
2.0 ABOUT THESE INSTRUCTIONS
3.0 TOOLS NEEDED
4.0 PRE-INSTALLATION AND HARNESS ROUTING GUIDELINES
5.0 GENERAL INSTALLATION INSTRUCTIONS
6.0 60219 or 60220 VORTEC FUEL INJECTION HARNESS KIT
7.0 GM 00-02 VORTEC SYSTEM WIRE HARNESS INSTALLATION
8.0 TROUBLE-SHOOTING INSTRUCTIONS

Sections are further divided into **Paragraphs** and **Steps**. Throughout, the **Figure** numbers refer to illustration and the **Table** numbers refer to information in table form. These are located in or near the sections or paragraphs to which they correspond. Always pay careful attention to any notes or any text labeled **CAUTION**.

3.0 TOOLS NEEDED

In addition to your regular tools, you will need, at least, the following:

Crimping tool **NOTE: USE A QUALITY TOOL TO AVOID OVER-CRIMPING.**
Wire stripper
Continuity tester **CAUTION: DO NOT USE A TEST LIGHT TO TEST THE COMPUTER OR SENSOR WIRING OR YOU WILL DAMAGE THE COMPUTER.**
Tech II or equivalent scanner (for presetting and diagnostic purposes)
Electric drill
1 5/8" Hole saw (for the rubber grommet in the firewall)

4.0 CONTENTS OF THE 60219 & 60220 WIRE HARNESS KIT

Take inventory to see that you have everything you are supposed to have in this kit, if anything is missing, contact the dealer where you obtained the kit or contact Painless Performance at (800) 423-9696 or (817) 244-6898.

The kit should contain the following items:

~ The main wire harness with the connectors already on the ends of most of the wires
~ Fuel Injection Installation Instructions P/N 90559 (This Booklet)
~ 4” & 7” tie wraps
~ TAC Module to Accelerator Pedal Pigtail

5.0 PRE-INSTALLATION AND HARNESS ROUTING GUIDELINES

The installation of your harness kit will consist of two parts:

~ The physical routing, positioning, securing, group/ individual wires and connectors.

~ The proper electrical connection of the individual circuits.

We cannot tell you how to route the harness in your automobile. That depends a great deal upon the particular make of the automobile and what extent you want to secure and conceal the harness.

We do offer some general guidelines and routing practices starting in **Paragraph 5.3**, general installation instructions in **Section 5.0**, and precise instruction concerning the electrical connections you will have to make beginning in **Section 6.0**. To help you begin thinking through the installation of your wire harness, read the following sections:

5.1 TRANSMISSION FUNCTION

5.1.1 Which ever transmission you are using ,**4L60E, 4L65E, 4L80E, or 4L85E transmission**, you must ensure the following components are connected correctly: vehicle speed sensor(VSS), transmission connector, park neutral position connectors and correct brake switch. These are necessary to make the transmission work correctly. The brake switch should be closed (electrically connected) when the brakes **ARE NOT** being applied and open (not electrically connected) when the brakes **ARE** being applied. This is the opposite of a standard brake light switch. If you are using a pressure brake switch, a **SPDT** relay must be installed to unlock the converter when the brakes are applied. The vehicle speed sensor lets the computer know how fast the wheels are turning. The park neutral position sensor tells the PCM if the transmission is in park or neutral.

5.2 YOU SHOULD GET TO KNOW THE PARTICULAR ENGINE YOU ARE USING:

NOTE: The 00–02 4.8L, 5.3L & 6.0L TBW Vortec engines had four oxygen sensors from the factory, but we have provisions for only two, one on the driver side and one on the passenger side of the engine. We removed the two rear oxygen sensors since they originally where behind the catalytic converters and most people don't want to run more than two oxygen sensors.

5.2.1 PPPI recommends the use of the following parts. See **Table 4.1**. These will meet all requirements and are compatible with PPPI harnesses. The numbers given are GM and AC Delco part numbers. **You must use the computer part #12200411.**

5.2.2 Familiarize yourself with the harness by locating each of the harness groups and by looking at the connectors on the wire ends.

5.2.3 Decide where and how the computer, TAC Module, fuse block, and relays will be mounted. PPPI wire harness kits are designed to mount either under the dash or in the kick panel on the right side.

5.2.4 A good exercise is to lay out the wire harness on the floor beside your vehicle and identify all the connectors and wires.

5.2.5 You will want to route the harness through and around open areas. Inside edges provide extra protection from hazards and also provide places for tie wraps, clips, and other support.

5.2.6 Route the harness away from sharp edges, exhaust pipes, and the hood, trunk, and door hinges.

5.2.7 Plan where harness supports will be located. Use a support approximately every 6 inches unless the harness routes under the floor carpet.

4.8L, 5.3L & 6.0L TBW Vortec Fuel Injection Harness (00 - 02) Part # 60219 & 60220

Main Computer……Service#12200411	MAP Sensor……..…Delco# 213-796
Fuel Pump Relay……...PPP #80130	Knock Sensor……....Delco# 213-362
Brake Switch……PPI# 80176	TAC Module……..Delco#12571991
MAF/ IAT Sensor……Delco# 213-364	Coils…….…..GM# 10457730
Engine Coolant Temperature……Delco# 213-953	Cam Position Sensor……..GM# 12561211
Oxygen Sensor (Pass. Side)……..Delco# AFS106	Crankshaft Position Sensor……Delco# 213-354
Oxygen Sensor (Drvr. Side)……..Delco# AFS106	Accelerator Pedal……...Delco#15177923
Throttle Body……Delco# 17113659	

Table 5.1 Compatible Parts

5.2.8 Allow enough slack in the harness at places where movement could possibly occur (body to frame, frame to engine, etc.).

5.2.9 The wires should be bundled into harness groups. Use tape, nylon ties, or poly split loom.

6.0 GENERAL INSTALLATION INSTRUCTIONS

- **DO NOT DISCONNECT THE BATTERY OR THE COMPUTER CONNECTORS WHILE THE IGNITION IS ON.**
- **DO NOT SHORT ANY WIRES IN THIS HARNESS TO GROUND (WITH THE EXCEPTION OF LABELED GROUND WIRES) OR DAMAGE TO THE COMPUTER WILL RESULT.**
- **GIVING OR RECEIVING A "JUMP START" MAY DAMAGE THE COMPUTER.**
- **DO NOT USE A TEST LIGHT WHEN TESTING COMPUTER SENSORS OR COMPUTER CIRCUITS. DAMAGE TO THE COMPUTER WILL RESULT!**
- **WHEN ROUTING THE WIRES FOR THE VEHICLE SPEED SENSOR MAKE CERTAIN THAT THEY ARE AT LEAST 12 INCHES AWAY FROM ANY IGNITION WIRING (SPARK PLUG WIRES, ETC.).**

NOTES:

- **There is a normal, small current drain on these fuel injected systems.**
- **Each connector in this harness is different and will not fit in the wrong place, with the exception of the Crank and Cam position sensors. NEVER FORCE ANY CONNECTOR.**
- **When connecting the plugs to the computer USE EXTREME CARE to make sure none of the pins in the computer are or become bent.**
- **The fuel pump you are using MUST maintain a constant pressure of 55-62 P.S.I. (pounds per square inch). The Vortec fuel system does have a built-in regulator on the fuel rail as in many earlier GM fuel injection systems.**

6.1 GROUNDING THE VEHICLE

A perfectly and beautifully wired automobile will nevertheless have problems if everything is not properly grounded. Don't go to the effort to installing a quality wire harness only to neglect proper grounding.

Note: The installer of this harness is responsible for all ground wires not provided with this part.

6.1.1 Connect a ground strap or cable (minimum of a 4 Ga. wire) from the negative battery terminal to the chassis (frame).

6.1.2 Connect a ground strap (minimum of a 4 Ga. wire) from the engine to the chassis (frame). **Do not rely upon the motor mounts to make this connection.**

6.1.3 Connect a ground strap from the engine to the body.

6.2 ROUGH INSTALLATION

CAUTION: DISCONNECT THE POWER FROM YOUR VEHICLE BY REMOVING THE NEGATIVE BATTERY CABLE FROM THE BATTERY.

Note: Make no wire connections or permanent mounting of any kind at this time.

6.2.1 Position the computer and TAC Module in their intended locations.

6.2.2 Drill a 1-5/8" hole for the firewall grommet near the computer for the engine group and tail section to pass through.

6.2.3 Route the engine group and tail section through the hole. Push the grommet (already installed on the harness) into the hole until it is seated.

6.2.4 Route the dash group over to the driver's side of the car.

6.2.5 Route the fuse block and relays to the place they will be mounted.

6.3 HARNESS ATTACHMENT

Note: Harness routing and shaping will be a time-consuming task. Taking your time will enhance the beauty of your vehicle. Please take your time and be patient.

6.3.1 Permanently mount your computer and TAC Module. You should also mount the fuse block and relays at this time.

6.3.2 Mold harness groups to the contour of the dash, engine, frame, etc. Remember to route harness away from sharp edges, exhaust pipes, hinges, and moving parts.

6.3.3 Attach harness groups to your automobile with clips or ties starting at the computer and working your way outward.

Note: Do not tighten tie wraps or mounting devices at this time. Make all harness attachments LOOSELY.

6.3.4 When used every 1-1/2" or so on the visible areas of the harness, colored plastic wire ties make a very attractive assembly. Otherwise, a tie installed in other areas every 6" or so will hold the wires in place securely. **REMEMBER TO TAKE YOUR TIME**.

6.4 TERMINAL INSTALLATION INSTRUCTION

Note: In the following steps you will be making the circuit connections. Before you start, you should carefully read Section 7.0, and continually refer to the wire charts, DOUBLE CHECKING your length calculations before cutting any wire or making any connections. These directions are for the wires, which do not have a connector already, installed on them.

6.4.1 Have all tools and connectors handy.

6.4.2 Select the correct terminal for the wire and application.

6.4.3 Determine the correct wire length and cut the wire. Remember to allow enough slack in the harness and wires at places where movement could occur. **DOUBLE CHECK YOUR CALCULATIONS**.

6.4.4 Strip insulation away from wire. Only strip as much insulation off as necessary for the type of terminal lug you are using.

Note: In the following step, make sure that the terminal is crimped with proper die in the crimping tool. An improper crimp will not make a good connection. DO NOT OVER-CRIMP.

6.4.5 Crimp the terminal onto the wire.

6.4.6 Connecting the wires and connectors throughout the harness is a simple process. Make sure that each wire is properly routed and then attached.

6.4.7 When all the wires are attached, tighten the mounts and ties to secure the harness permanently.

6.4.8 Attach both ECM connectors to the computer and both TAC Module connections to the TAC Module. These connections are: the Accelerator pedal to the TAC Module and the main harness to the TAC module. See **Figures 6.1** & **6.2**
BE VERY CAREFUL NOT TO BEND ANY PINS.

6.4.9 After all connections have been made throughout the harness, connect the battery to the vehicle.

CAUTION: BE SURE THE IGNITION IS OFF WHEN YOU RECONNECT THE BATTERY OR YOU WILL DAMAGE THE COMPUTER.

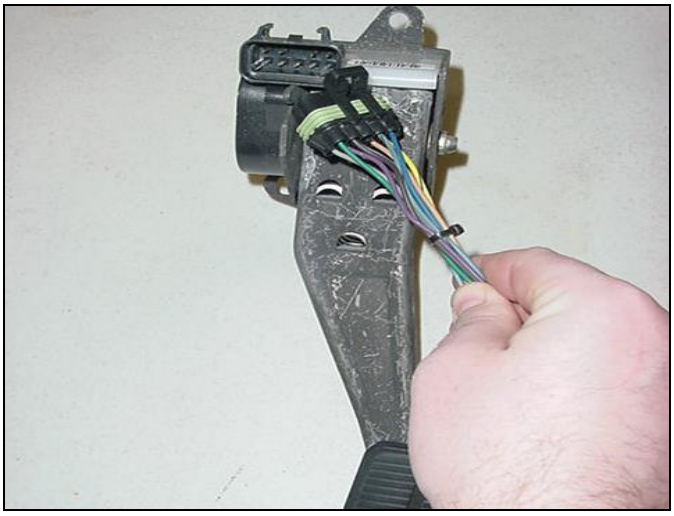

FIGURE 6.1 Accelerator Pedal

FIGURE 6.2 TAC Module Connections

7.0 GM 00 – 02 4.8L, 5.3L & 6.0L TBW VORTEC SYSTEM WIRE HARNESS INSTALLATION INSTRUCTIONS

7.1 DASH SECTION INSTALLATION

Note: If you have not already done so, read sections 5.0 and 6.0 of these instructions and think through the installation of the harness before securing or cutting any wires.

The wires in this group consist of the diagnostic link connector (DLC) (**SEE FIGURE 7.1**), the check engine light (pre-mounted into a mounting bracket), fuel pump relay, emissions devises (optional) and 6 other wires.

CAUTION: DO NOT MAKE ANY CONNECTIONS WHILE THE COMPUTER IS PLUGGED INTO THE HARNESS.

Note: Wire color (Example: Blk/Wht) is one wire with a stripe. The second color (the stripe) may not be bold. Observe all two-color wires closely.

A. AC REQUEST – <u>This is not a power supply for the compressor</u>
This circuit is used to inform the PCM that the AC compressor has been turned on. This wire is to be spliced into the circuit from the AC switch to the AC compressor.

B. BRAKE SW - These circuits are used to provide power to the TCC solenoid in the automatic transmission. These wires will connect to the brake switch terminals that are normally used for cruise control or TCC solenoid (normally closed). **<u>These wires do not connect to the terminals for the brake lights.</u>** See table 4.1 for the recommended brake switch. If you are using the recommended brake switch then you will wire it according to **Figure 7.2**. The pink wire to the back of the switch in the illustration is the wire that has power on it whether or not the brake is being applied. If your vehicle has a pressure type brake switch, you may use a relay as shown in **Figure 7.3**. The relay must be a **SPDT Relay** and wired correctly or it could result in a dangerous situation with the vehicle. The torque converter may not unlock.

C. DLC - The Data Link Connector **(DLC) Figure 7.1** is used to communicate with the PCM. The Powertrain On Board Diagnostic **(OBD)** System Check is an organized approach to identifying a problem created by an electronic powertrain control system malfunction. The Powertrain OBD System Check is the starting point for any drivability concern diagnosis. The Powertrain OBD System Check directs the installer to the next logical step in diagnosing a drivability concern. Understanding and using the Powertrain OBD System Check correctly will reduce the diagnostic time and prevent the replacement of good parts. Mount the DLC connector using the bracket that the light is mounted in allowing access to the front of the connector allowing you to see the light while driving. **See Figure 7.1**

D. FUEL TEST (use as needed) - This circuit is used to power the electric fuel pump for test purposes only. Temporarily apply fused positive power to this wire for testing the fuel pump.

E. FUSE BLOCK IGNITION - This circuit is used to provide power to the injection system. Connect this wire to a terminal/ wire from the ignition switch that is hot in the **RUN** and **CRANK** positions. Failure to provide power in the crank position will result in PCM shutdown while the engine is trying to start. *Note: You will know this circuit is properly connected if the **Check Engine Light** is on when the ignition switch is on and while starting.*

F. TACH (optional) - This circuit is used to provide a signal from the PCM to the tachometer. Connect this wire to the signal input on the tachometer.

G. VSS OUTPUT (optional) - This circuit is used to provide a signal from the PCM to the electric speedometer. Connect this wire to the signal input on the electric speedometer (not all aftermarket electric speedometers use the same signal for operation. Consult the tech dept of the speedometer manufacture for compatibility).

H. Cruise Control- There are four cruise control wires in this harness. Most late model GM steering columns years 1983-1993 already have or can be retrofitted with a cruise control switch. See **Figure 7.4** for the proper connection of these wires to a factory GM cruise control switch part number 25111262. This harness kit does not include the connector needed because it has been discontinued by Delphi. The Brown wire is power (connector pin A). The Gray wire is the *cruise control on* switch signal (connector pin B). The Blue wire is the *cruise control set/coast* switch signal (connector pin D). The Gry/Blk wire is the *cruise control resume/acce*l switch signal (connector pin C).

I. Fuel Pump Relay- Plug this connector into the fuel pump relay (PPP #80130) See **Figure 7.5**

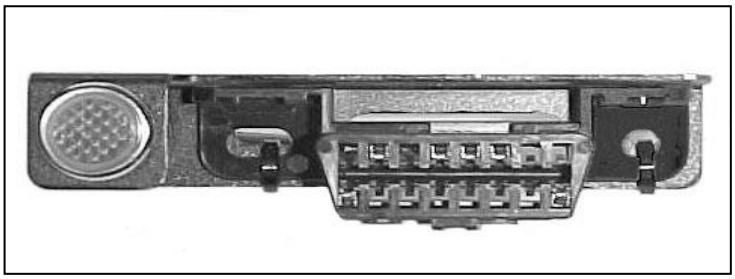

FIGURE 7.1 DLC Connector & Check Engine Light

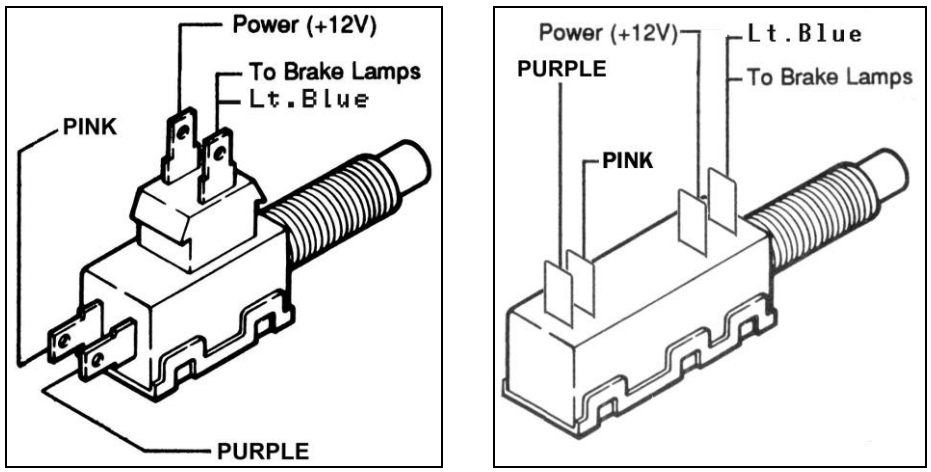

FIGURE 7.2 Brake Switch Connections

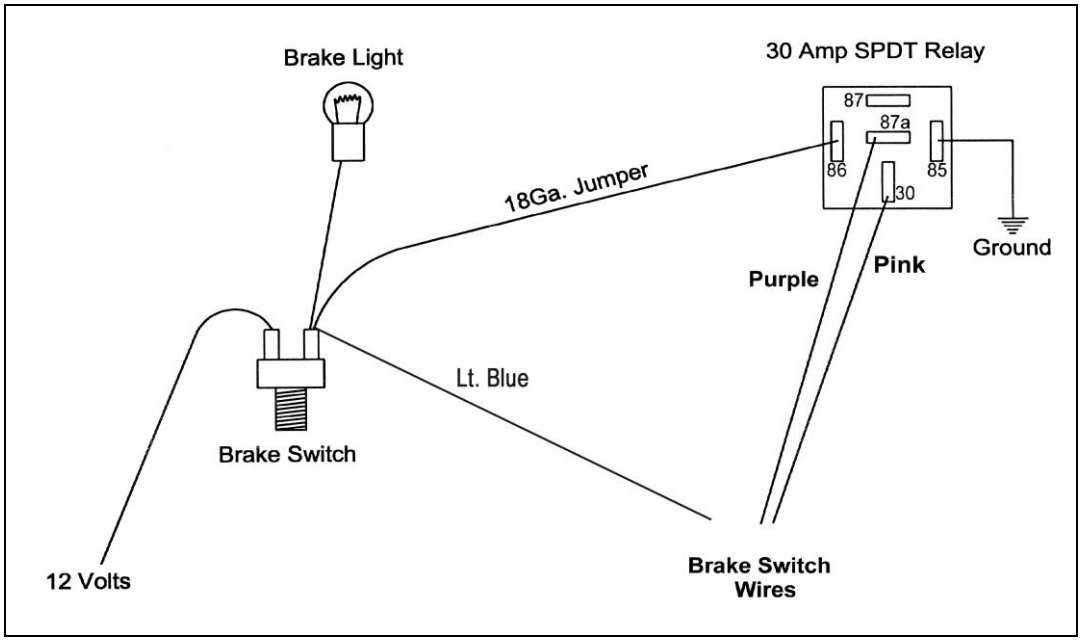

FIGURE 7.3 Brake Switch Relay

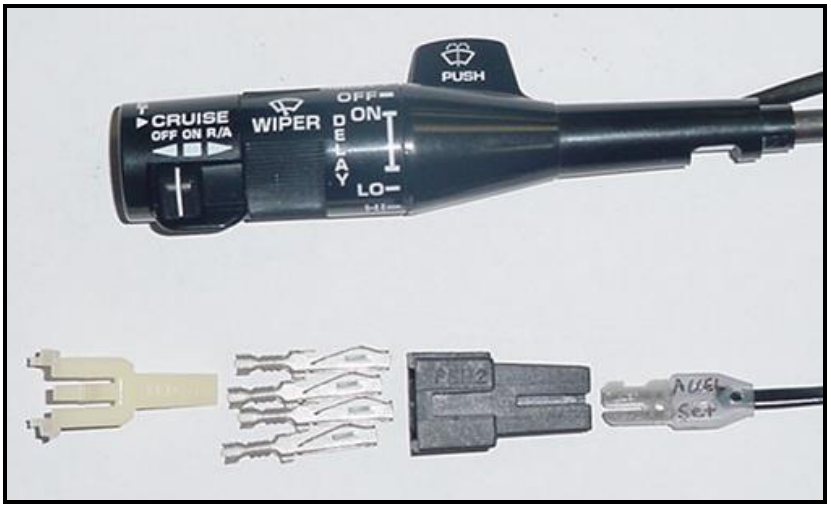

FIGURE 7.4 Cruise Control

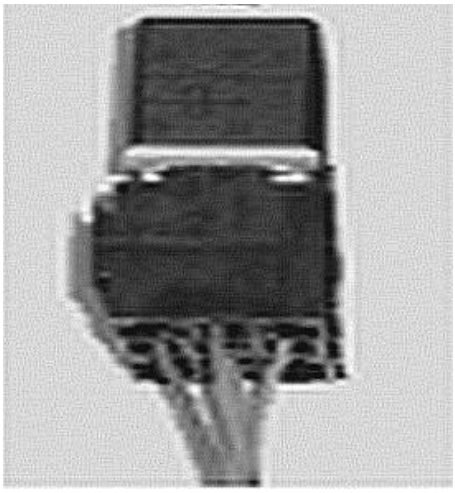

FIGURE 7.5 Fuel Pump Relay Connector

WIRE COLOR IN CONNECTOR	# OF WIRES	LABELED	CONNECT TO:
Gray, Green/White, Black, Orange	4	Fuel Relay	Fuel Pump Relay
Green/White	-	VSS Output	Speedometer
White	-	Tach	Tachometer
Pink, Purple	-	Brake Switch	Brake Switch
Pink	-	Fuse Block Ignition	Ignition Power
Green/ White	-	AC Request	Compressor B+
Gray	-	Fuel Test	See Paragraph 6.2.1
Gray, Blue, Gray/Black, Brown	-	Cruise Control	Cruise Control Switch

TABLE 7.1 Dash Section Connections

7.2 ENGINE GROUP INSTALLATIONS

The engine group is designed to be separated into left (driver) and right (passenger) sections. Each side is tie-wrapped separately, **BUT NOT LABELED**. The left side of the has the connectors for the throttle position sensor, mass air flow sensor, and engine coolant sensor, all of which **ARE** labeled. When you begin routing, **FIRST** separate the engine group into left and right sections, and place them accordingly.

Note: Before you connect any wires, separate the tail section from the engine group and place it out of the way.

A. **ALT-** This circuit is used to excite (turn on) the voltage regulator. When using the stock alternator equipped on the 4.8, 5.3 or 6.0L Vortec engines, this connector will connect into the voltage regulator plug.

B. **CKP-** The Crankshaft Position **(CKP)** sensor provides the PCM with crankshaft speed and crankshaft position. The PCM utilizes this information in order to determine if an engine misfire is present. The PCM monitors the CKP sensor for momentary drop in crankshaft speed in order to determine if a misfire is occurring. **See Figure 7.11**

C. **CMP-** The Camshaft Position **(CMP)** sensor provides the PCM with camshaft speed and position. The PCM monitors the CMP sensor for any momentary drops in camshaft speed in order to determine if a misfire is occurring. **See Figure 7.10**

D. **DRVR. & PASS COIL-** The ignition system on this engine is a multiple coil configuration called "coil on plug". The ignition coil mounting bracket is attached to the rocker cover. The secondary ignition, or spark plug, wires are short compared to a distributor ignition system wire. **See Figure 7.17 & 7.18**

E. **ECT -** The (PCM) supplies a **5.0 volt** signal to the Engine Coolant Temperature **(ECT)** sensor through a resistor in the PCM and measures the voltage. The voltage is high when the engine is cold. The voltage is low when the engine is hot. The PCM calculates the engine coolant temperature by measuring the voltage. The engine coolant temperature affects most systems the PCM controls. **See Figure 7.19**

F. **GROUND (mandatory) -** These circuits are used to provide ground for the various devises. Connect these wires under a bolt in the engine block, transmission, or cylinder head. These are the grounds for the entire injection system. For best results from your EFI system, be certain your grounding surfaces are clean and your connections are secure.

G. **INJ #1 - #8 –** The Multec 2 fuel injector assembly is a solenoid operated device, controlled by the PCM that meters pressurized fuel to a single engine cylinder. An injector that has been sitting for more than 6 months will need to be cleaned/ replaced as the varnish residue in the fuel will cause the injector to stick closed. This will keep the injector from delivering fuel as needed by the injection system. **See Figure 7.12 & 7.13**

H. **KNOCK –** To control spark knock, a Knock Sensor **(KS)** system is used. This system is designed to retard spark timing up to **20 degrees** to reduce spark knock in the engine. This allows the engine to use maximum spark advance to improve drivability and fuel economy. **See Figure 7.7**

I. **LEFT & RIGHT O2 SEN.–** The PCM uses the signal voltage from heated oxygen sensors in a Closed Loop to adjust the fuel injector pulse width. In Closed Loop, the PCM adjust fuel delivery to maintain an air to fuel ratio which allows the best combination of emission control and drivability. **See Figure 7.8**

J. **MAF-IAT –** The Mass Air Flow **(MAF)** sensor measures the amount of air which passes through the sensor. The PCM uses this information to determine the operating condition of the engine in order to control the fuel delivery. A large quantity of air indicates acceleration. A small quantity of air indicates deceleration or idle. **See Figure 7.16**

K. **MAP–** The Manifold Absolute Pressure **(MAP)** sensor responds to changes in the intake manifold pressure as a result of engine load and speed. The map sensor converts this to a voltage output. **See Figure 7.9**

L. **TAC MOTOR-** The TAC Motor is responsible for the movement of the throttle body blade. It receives signal from the TAC Module, according to the accelerator pedal position the TAC Module sees. **See Figure 7.15**

N. **STARTER B+-** These circuits are used to maintain memory in the PCM and provide power to all heavy amp circuits. Connect these wires to the battery post on the starter solenoid (the same post as the positive battery cable) or to a positive high output battery source.

O. **TPS –** The TP sensor attaches to the side of the throttle body opposite the TAC motor. The TP sensor senses the throttle blade angle and relays that information to the control module. The control module requires knowledge of throttle angle in order to generate the required injector control signals, or pulses. **See Figure 7.14**

WIRE COLOR	# OF WIRES IN CONNECTOR	LABELED	CONNECT TO:
Black, Red, Green, Brown, Lt.Blue, Purple, Pink	7	DRVR. COIL	Drivers Coil
Black, Red/ White, Green/ White, Brown/ White, Lt.Blue/ White, Purple/ White, Pink	7	PASS COIL	Passenger Coil
Black, Tan, Black/ White, Pink, Yellow Lt. Blue/ White	5	MAF-IAT	Mass Air Flow Sensor
Tan/ White, Purple/ White, Black, Pink	4	LEFT O2 SEN	Left Oxygen Sensor
Tan, Purple, Black, Pink	4	RIGHT O2 SEN	Passenger Oxygen Sensor
Black/ White, Yellow/ Black, Lt.Green	3	CKP	Crankshaft Position Sensor
Brown/ White, Pink/ Black, Red	3	CMP	Camshaft Position Sensor
Orange/ Black, Lt.Green, Gray	3	MAP	Manifold Absolute Pressure Sensor
Gray, Black, Blue	3	TPS	Throttle Position Sensor
Gray, Yellow	2	ECT	Engine Coolant Temperature Sensor
Black, Pink	2	INJ #1	Driver Side Front Injector
Lt.Green/ Black, Pink	2	INJ #2	Passenger Side Front Injector
Pink/ Black, Pink	2	INJ #3	Driver Side 2nd Injector
Lt.Blue/ Black, Pink	2	INJ #4	Passenger Side 2nd Injector
Black/ White, Pink	2	INJ #5	Driver Side 3rd Injector
Yellow/ Black, Pink	2	INJ #6	Passenger Side 3rd Injector
Red/ Black, Pink	2	INJ #7	Driver Side Rear Injector
Blue/ White, Pink	2	INJ #8	Passenger Side Rear Injector
Blue, Lt. Blue	2	Knock	Knock Sensor
Brown, Gray	2	ALT	Alternator
Black,Yellow	2	TAC Motor	TAC Motor
Red (2)		STARTER B+	Starter Solenoid Batt Terminal
Black (3), Black/ White (3)		GROUND	Engine Ground

TABLE 7.2 Engine Section Connections

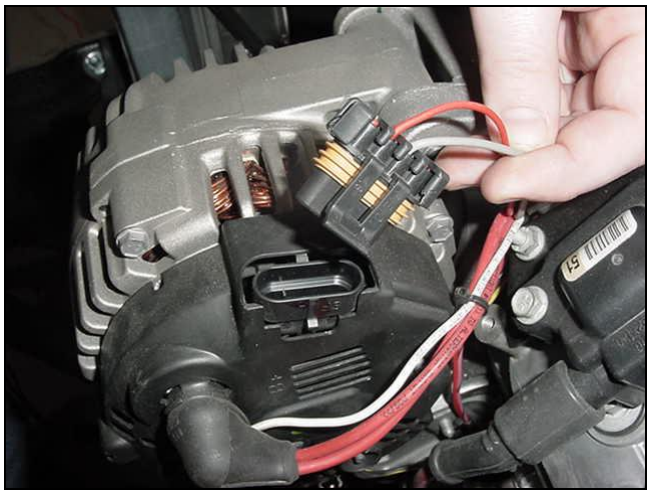

FIGURE 7.6 Alternator

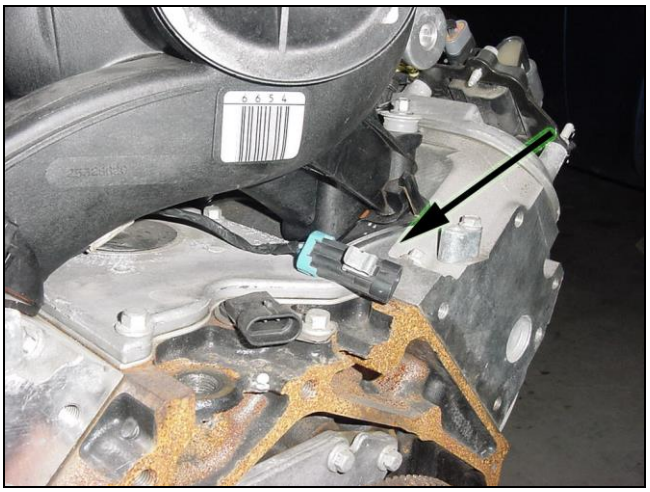

FIGURE 7.7 Knock Sensor Connector

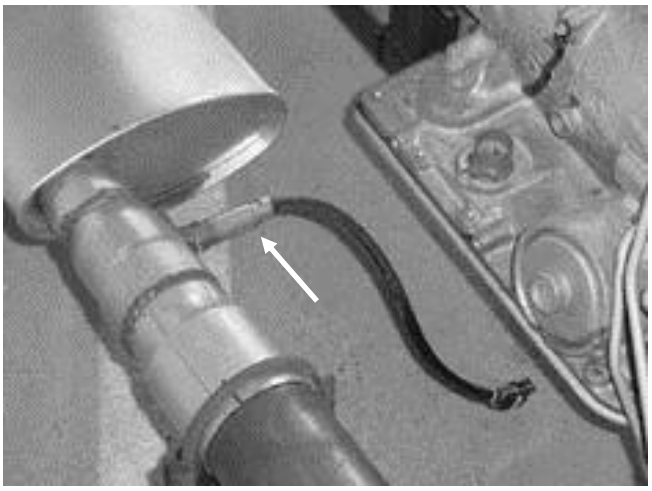

FIGURE 7.8 Oxygen Sensor

FIGURE 7.9 MAP Sensor

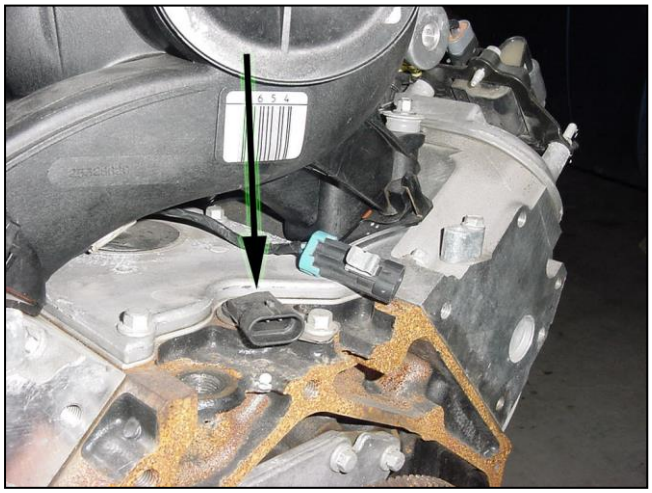

FIGURE 7.10 CMP Sensor

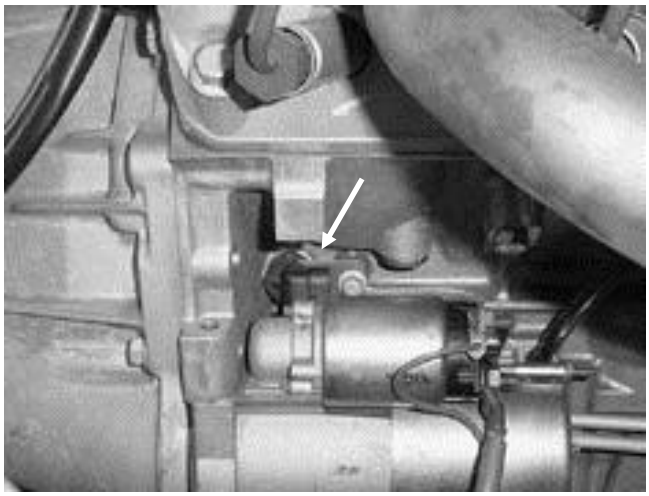

FIGURE 7.11 CKP Sensor

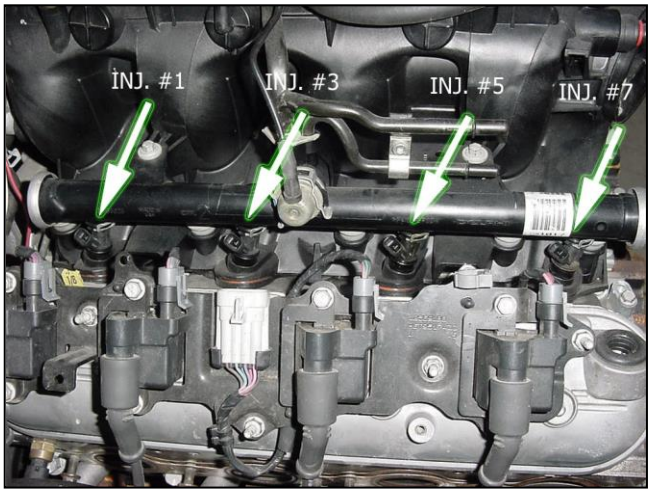

FIGURE 7.12 Injectors 1, 3, 5, 7

FIGURE 7.13 Injectors 2, 4, 6, 8

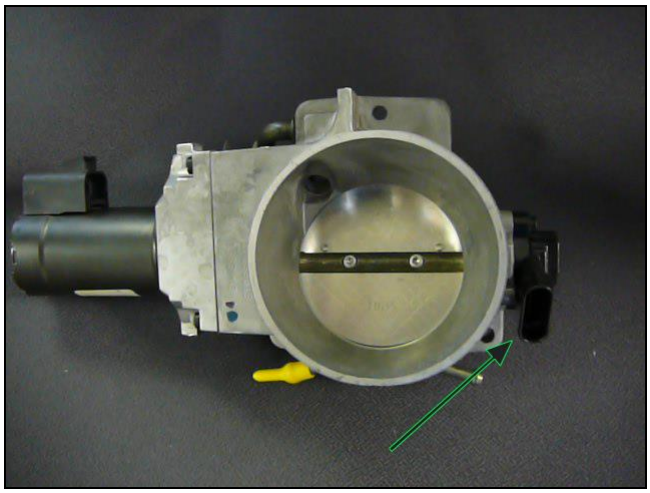

FIGURE 7.14 TPS Sensor

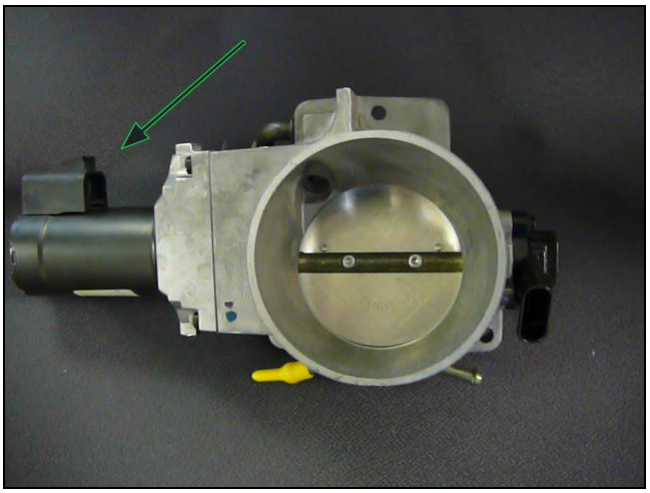

FIGURE 7.15 TAC Motor

FIGURE 7.16 MAF-IAT Sensor

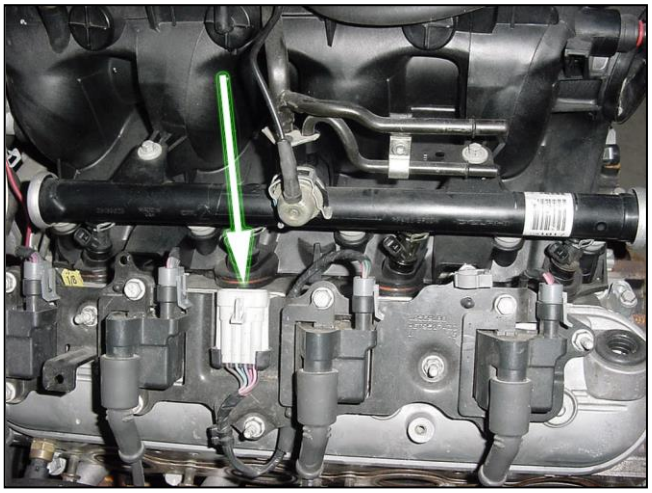

FIGURE 7.17 Driver Side Coil Connector

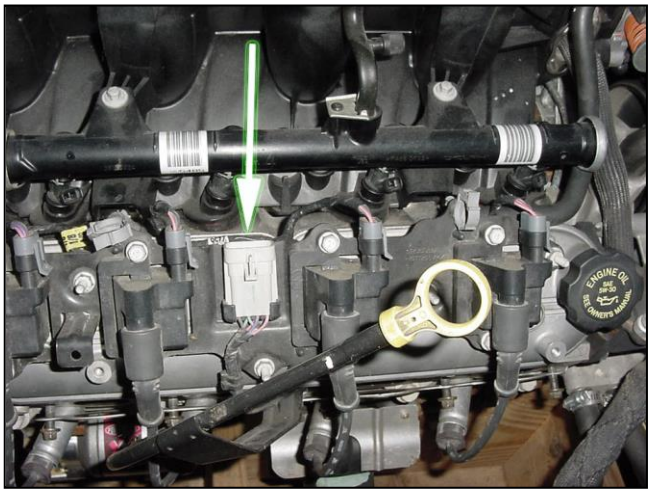

FIGURE 7.18 Passenger Side Coil Connector

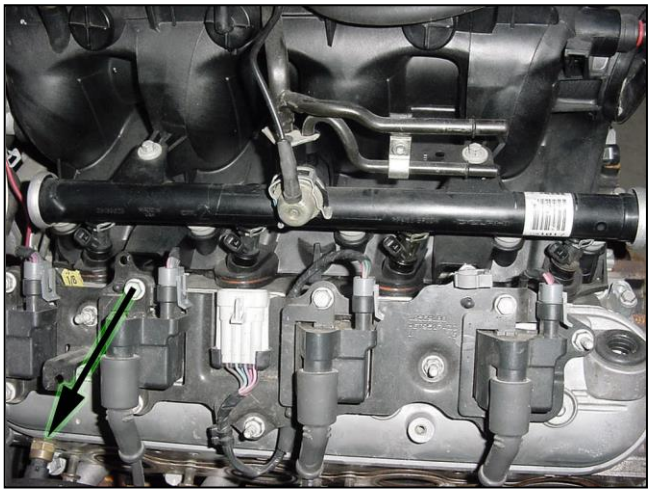

FIGURE 7.19 ECT Sensor

7.2 TAIL/TRANSMISSION GROUP INSTALLATION

Locate the tail section that you earlier separated from the engine group. Begin routing it towards the rear of the vehicle. Be sure to avoid all sharp edges, moving or hot parts, or anything else that may damage the harness.

A. **BACK-UP-** This circuit is used to power the back-up lamps. This wire will connect directly to the back-up light socket. You will need to splice a wire into this circuit in order to accommodate two back-up lights.

B. **FROM START SWITCH-** This circuit is used to connect the start switch to the neutral safety switch. Connect this wire to a circuit from the ignition switch start position. This wire should only have power in the start position.

C. **FUEL PUMP-** This circuit provides power to the electric fuel pump. Connect this wire to the positive side of the electric fuel pump. **This wire only has power for a few seconds when the ignition switch is turned on. It will have constant power while the engine is cranking/ running.**

D. **INPUT SPEED SEN (optional) (not equipped on all models) –** This connection is only used on the 4L80E/ 4L85E transmissions. This can be stowed if not needed.

E. **OUTPUT SPEED SEN –** The Vehicle Speed Sensor **(VSS)** is a pulse counter type output that informs the PCM how fast the vehicle is traveling. The VSS system uses an inductive sensor, mounted in the tail housing of the transmission, and a toothed reluctor wheel on the tail shaft. The teeth of the reluctor wheel alternately interfere with the magnetic field of the sensor creating an induced voltage pulse as the reluctor rotates.

F. **PNP–** The Transmission Range Switch **(PRND)** switch is mounted to the side of the transaxle and is part of the Park Neutral Position **(PNP)** switch. The PRND switch is used by the PCM to indicate the actual gear selected. The PRND is made up of 4 individual switches. The scan tool indicates ON or OFF for each switch depending on the position of the gear selector lever. The combination of ONs and OFFs will indicate the gear selected. If the combination of ONs and OFFs is invalid, a DTC is set.

G. **TO STARTER RELAY (optional) -** This circuit is used to connect the neutral safety switch to the starter relay terminal #85. Connect this wire to the circuit in terminal #85 of the starter relay. **DO NOT CONNECT THIS CIRCUIT DIRECTLY TO THE STARTER SOLENOID.** You can substitute Painless part #30202 (Hot Shot Relay) if the stock starter relay is not available.

H. TRANS– These circuits are used by the PCM to determine vehicle speed, gear position and control shift patterns.

WIRE COLOR	# OF POSITIONS IN CONNECTOR	LABELED	CONNECT TO:
Blue, Pink/White, Lt.Green, Red, Yellow/Black, Black, Tan/Black, Brown, Lt.Blue/White, Red/Black, Yellow, Pink, White	13	TRANS	Transmission
Pink, Black/White, Purple/ White, Yellow, Lt.Green	5	PNP	Park Neutral Position Sensor
Black/ White, Gray, White, Yellow	4	PNP	Park Neutral Position Sensor
Red/ Black, Blue/ White	2	INPUT SPEED SEN	Input Speed Sensor
Lt.Green/ Black, Purple/ White	2	VSS SEN	Output Speed Sensor
Gray		FUEL PUMP	Fuel Pump B+
Purple/ White		FROM START SWITCH	Start Switch
Lt.Green		BACK-UP	Back-up Light Bulbs
Yellow		TO START RELAY	Starter Relay Activation

TABLE 7.3 Tail Section Connections

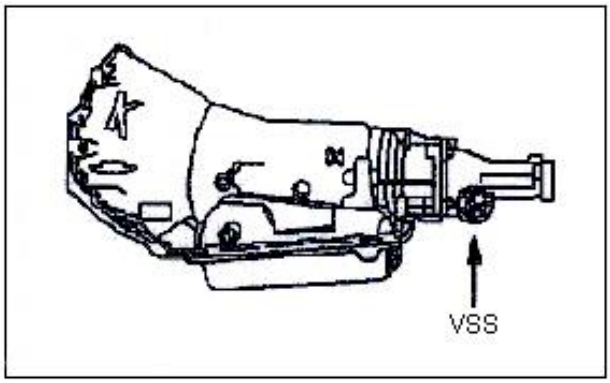

FIGURE 7.20 VSS Sensor (4L60E)

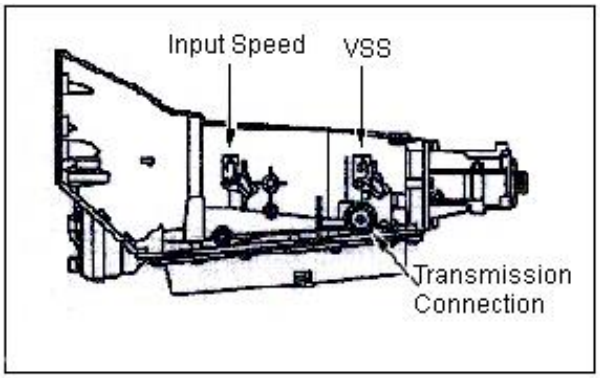

FIGURE 7.21 VSS & Input Speed Sensor, Transmission Connection (4L80E)

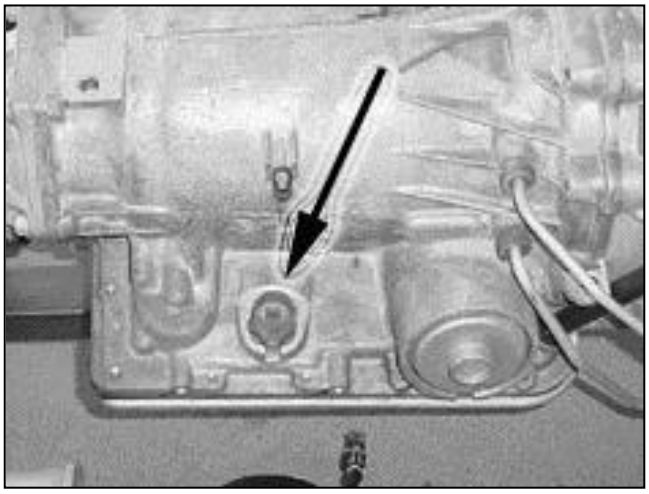

FIGURE 7.22 Transmission Connection

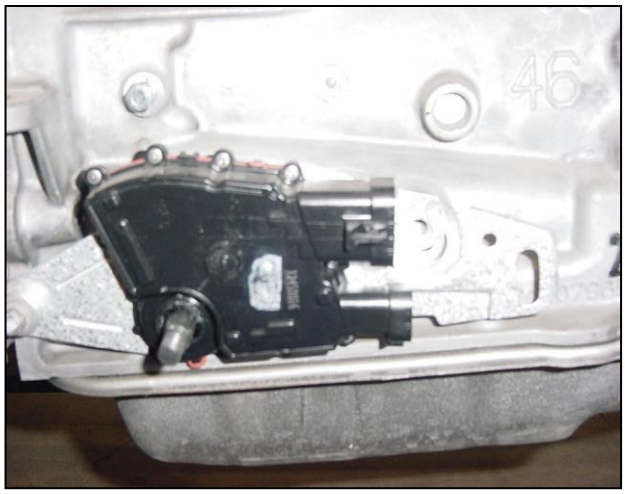

FIGURE 7.23 Park Neutral Position Sensor

7.4 Converting the 4L60E Transmission Connector to a 4L80E Connector

*__Note__: Harness numbers 60219 and 60220 have been wired for both the 4L60E and the 4L80E. All harnesses have the transmission connector pre terminated to allow use of the 4L60E transmission. In applications where a 4L80E is to be used, follow this procedure to change your transmission connector to ensure all functions of the transmission work properly. See Figure 6.28 for re-pinning the transmission connector

1. With the terminal end of the connector and the arrow on top pointing towards you, carefully remove the white retaining lock located in the center of the connector.

2. Locate the white wire located in terminal location S. Using a paper clip or small screwdriver, gently lift the locking tab inside the connector and pull the wire from it's location.

3. Now locate the brown wire located in terminal location U. Using the same method, remove the brown wire from it's location

4. Gently insert the brown wire into terminal location S.

5. The white wire has no function with the 4L80E transmission; it needs to be taped up and stowed in the harness in case a 4L60E is ever to be used.

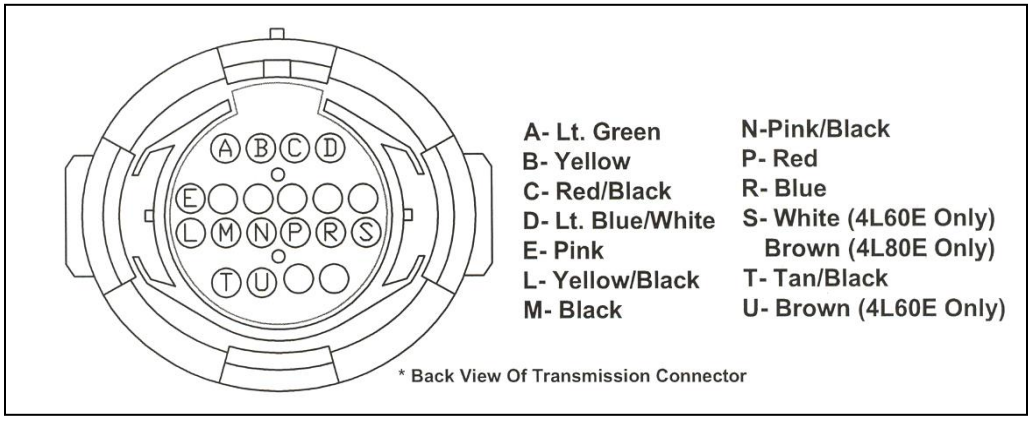

Figure 7.24 Transmission Connector Pin Out

8.0 TROUBLE- SHOOTING INSTRUCTIONS

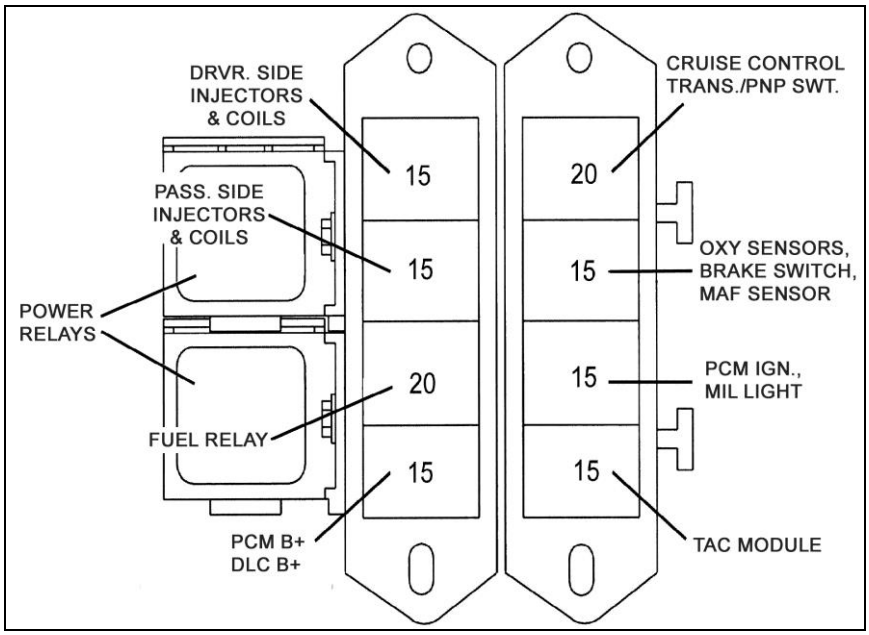

FIGURE 8.1 Fuse Identification

8.1 THE "CHECK ENGINE" LIGHT

Normally, the "check engine" light should come on when the ignition is turned on, and then go out a few moments after the engine starts running. If it reappears, or stays on while the engine is running, the computer has detected a problem and a trouble code has been set.

> *NOTE: Most likely the check engine light will come on and stay on when using a computer with the original factory programming. This is why we recommend that the computer be reprogrammed to remove any items that the factory vehicle had that aren't being used in the vehicle you are installing the engine into.*

8.2 RETRIEVING TROUBLE CODES FROM THE COMPUTER

Diagnosing problems in modern automobiles can sometimes be very frustrating and confusing, especially when it involves computer controlled systems. The fact is, for the most part automotive electronics have been proven quite reliable, and the greatest number of problems with new cars is the same kinds of problems that older cars without computer controls have.

Begin all troubleshooting by checking the basics. Certain basic faults may be undetectable by the Powertrain Control Module **(**PCM**)** self-diagnostic system and can actually interfere with self-checking and fault memory operation. Low battery voltage, for example, can cause erroneous faults to set in PCM memory or can cause a system to go "Fail Safe" without setting a fault in memory. Because system faults memory is cleared whenever PCM or battery are disconnected, fault codes should be read prior to any vehicle power interruption or troubleshooting.

Before suspecting a computer problem, perform a careful visual inspection. Check under the hood for the same kinds of problems you would look for on a non-computer controlled engine. These include fluid leaks, vacuum leaks, dirty filters, overheating, oil burning, poor connections or loose wires, bad spark plug wires and/or spark plugs, restricted mufflers and exhaust systems, worn mechanical parts, exhaust leaks, and other familiar kinds of problems. Be thorough! You may save a lot of time. The PCM is designed to withstand normal current draws associated with vehicle operations. Avoid overloading any circuit.

PROCEDURE

A Tech II or equivalent Scan tool **must be used** to check or clear Diagnostic Trouble Codes **(DTCs)** from the PCM memory. When clearing DTCs, follow the instructions supplied by the Scan tool manufacturer.

Once a DTC has been identified, contact the Painless tech dept. or a GM Service Manual for a procedure to identify why a particular code is being set. Do not assume a code for a component is the result of the component being faulty.

We have attempted to provide you with the most accurate instructions possible, and are always concerned about corrections or improvements that can be made. If you have found any errors or omissions, or if you simply have comments or suggestions concerning these instructions, please write us at the address on the cover and let us know about them. Or, better yet, send us a fax at (817) 244-4024. We sincerely appreciate your business.

Painless Performance Limited Warranty and Return Policy

Chassis harnesses, fuel injection harnesses, and Striker ColdShot units are covered under a lifetime warranty.

All other products manufactured and/or sold by Painless Performance are warranted to the original purchaser to be free from defects in material and workmanship under normal use. Painless Performance will repair or replace defective products without charge during the first 12 months from the purchase date. No products will be considered for warranty without a copy of the purchase receipt showing the sellers name, address and date of purchase. You must return the product to the dealer you purchased it from to initiate warranty procedures.

NOTES: