

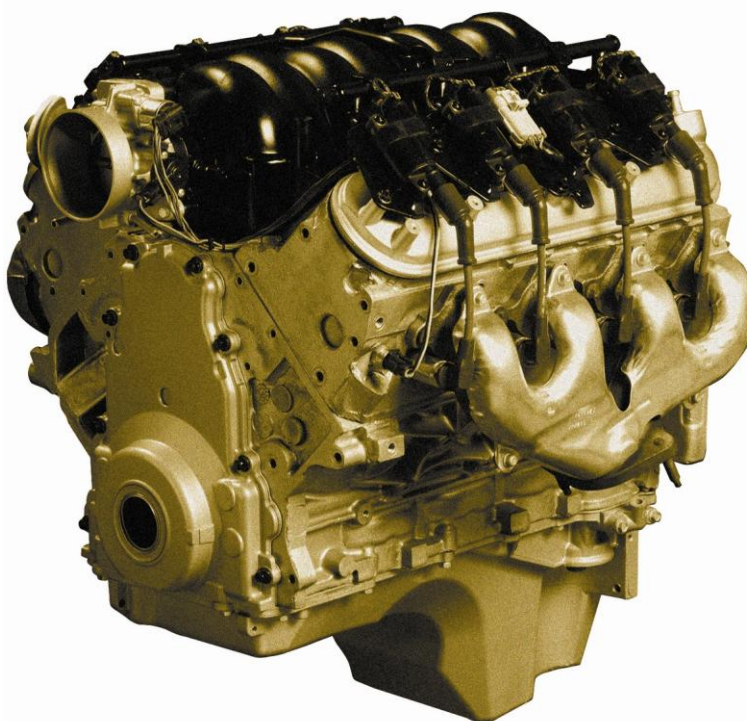


Wire Harness Installation Instructions

For Installing:

Part # 65106 – 1997-2004 (5.7L) LS-1 Engines

Part # 65206 – 1997-2004 (5.7L) LS-1 Engines



Manual # 90538

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1.0 INTRODUCTION

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

This kit is designed to be a complete system for fuel injection on all stock General Motors LS-1 engine (**non-throttle by wire motors**). This includes all wiring that is need by the computer to run and control the fuel injection system. Please note that the PERFECT computer does not have the capability to control an electronic transmission. If you are running a 4L60E transmission you will need to contact an aftermarket transmission company for that computer and wiring harness. If you are running a 700 R4 trans. and would like to have the lock-up functions you can purchase Painless Performance part # 60109 for that function.

Usually, the computer, fuse block, relays, ALDL and check engine light 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 is rated at 275°F and has been GM color-coded.

This harness has been broken down into three major groups:

Engine Group	Includes wiring for the fuel injectors, coil plugs, sensors, fuel pump and coil power wire.
Dash Group	Includes ignition feed and tach. wires, ALDL, check engine light
Fuse block and Relay Group	Includes wiring for the fuse block, fuel pump relay, a/c relay, ignition relay, cooling fan relay ground and alternative fuel ground wire.

2.0 ABOUT THESE INSTRUCTIONS

These instructions provide information for the installation of the 65106 LS-1 fuel injection wire 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 GM LS-1 SYSTEM WIRING HARNESS INSTALLATION INSTRUCTIONS
- 7.0 TROUBLE SHOOTING INSTRUCTIONS AND TROUBLE CODES

Sections are further divided into **Paragraphs** and **Steps**. Throughout, the **figure** numbers refer to illustrations and the **Table** numbers refer to information in the 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

You will at least, need the following:

Crimping Tool
Wire Stripper
Continuity Tester

Note: Use a quality tool to avoid over-crimping.

CAUTION: Do not use a test light to test the computer or sensor wiring or you will damage the computer.

Electric Drill
1 5/8" Hole Saw
Digital Volt Meter

(for rubber grommet in the firewall)

4.0 PRE-INSTALLATION AND HARNESS ROUTING GUIDELINES

The installation of your harness kit consists mainly of two parts:

- ~ The physical routing, positioning, and securing of the harness, wire groups, and individual wires and connectors.
- ~ The proper electrical connection of the individual circuits.

These two major tasks are not separate steps, but are integrated together. That is you, will route some wires and make some connections, route some more wires and make some more connections.

We cannot tell you how to physically route the harness in your vehicle. That depends a great deal upon the particular make of vehicle and what extent you want to secure and conceal the harness. We do offer some general guidelines and routing practices starting in **Paragraph 4.2**, GENERAL installation instructions concerning the electrical connections you will have to make beginning in **Sections 6.0**. To help you begin thinking though the installation of your wire harness, read the following sections:

4.1 You should get to know the particular engine that you are installing the harness on:

THIS KIT WILL ELIMINATE THE MASS AIR FLOW (MAF) SENSOR, BUT WILL KEEP THE MANIFOLD ABSOLUTE PRESSURE SENOR (MAP). IT WILL USE (1) OXYGEN SENSOR. THIS SYSTEM WILL ONLY WORK WITH A CABLE THROTTLE SYSTEM. IF YOU HAVE A LATER CORVETTE STYLE ENGINE YOUR WILL NEED TO CHANGE YOU THROTTLE BODY TO AN EARLIER STYLE.

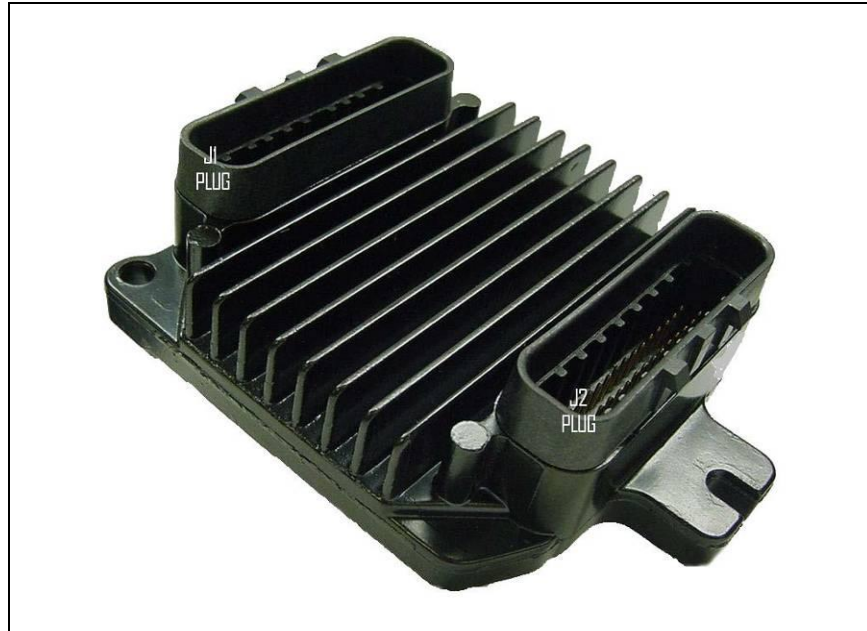


Figure 4.1 Engine Control Module (ECM)

- 4.1.1 PAINLESS PERFORMANCE recommends the use of all proper parts. See **Table 4.1** these parts will meet all requirements and are compatible with the Painless Performance harness and ecm. The numbers given are GM and AC Delco part numbers.
- 4.2 Familiarize yourself with the harness by locating each of the harness groups and by looking at the connectors on the wire ends.
- 4.3 Decide where and how the computer and relays will be mounted. Painless Performance wire harness kits are designed to mount either under the dash or on the lower kick panel. They must be no further apart than the wiring will allow (approx. 10 inches).
- 4.4 A good exercise is to lay out the wire harness on the floor beside your vehicle and identify all the connectors and wires. The harness must be routed from the inside of the vehicle out to the engine compartment.
- 4.5 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.
- 4.6 Route the harness away from sharp edges, exhaust pipes, the hood and door hinges.
- 4.7 Plan where harness supports will be located. Use support approximately every 6 inches unless the harness routes under the floor carpet.
- 4.8 Allow enough slack in the harness at places where movement could possibly occur (body to frame, frame to engine, ect.)
- 4.9 The harness should be bundled into harness groups. Use tape, nylon ties or poly-split loom.

LS-1 Fuel Injection Harness (1997-2004) Part # 65106

Engine Coolant Temp ...GM #12551708	Intake Air Temp Sensor ...Delco # 213-243
Throttle Position Sensor ...Delco #213-912	Oxygen Sensor ...Delco # AFS 105
MAP Sensor ...Delco # 213-331	IAC ...GM #17113391
Knock Sensors ...Delco# 213-362	Coils ...Delco #D580
CMP Sensors ...Delco # 213-335	CKP Sensor ...Delco # 213-354
Micro Relays ...Delco # D1703-A	

Table 4.1 Compatible Parts List

5.0 GENERAL INSTALLATION INSTRUCTIONS

CAUTION:

Do not disconnect the battery or computer connector(s) while the ignition is on.

Do not short any wire 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!

Notes:

- ~ There is a normal, small current drain on this fuel injection system.
- ~ Each connector in this harness is different and will not fit in the wrong place.
- 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 have become bent.
- ~ **The fuel pump and pressure regulator you use MUST maintain a constant pressure of 58 PSI (pound per square inch). If using a higher pressure pump you must add an inline regulator to bring the pressure down to the 58-60 range since the LS-1 fuel system does not have a built-in regulator on the fuel rail as in many earlier GM fuel injection systems.**

5.1 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 kit.

- 5.1.1 Connect a ground strap or cable (minimum of a 4 GA. wire) from the negative battery terminal to the chassis (frame).
- 5.1.2 Connect a ground strap from the engine to the chassis (frame). **DO NOT RELY UPON THE MOTOR MOUNTS TO MAKE THIS CONNECTION.**
- 5.1.3 Connect a ground strap from the engine to the body.

5.2 Rough Installation

CAUTION: Disconnect the battery power from your vehicle by removing the negative battery cable from the battery.

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

- 5.2.1 Position the computer in its intended location.
- 5.2.2 Drill a 1 5/8" hole in the firewall near the computer for the engine group wires to pass through.
- 5.2.3 Route the engine group section through the hole. Push the grommet (already installed on the harness) into the hole until it is seated.
- 5.2.4 Route the dash section group to the driver's side of the car.
- 5.2.5 Route the fuse block and relays to the area where they will be mounted.

5.3 Harness Attachment

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

- 5.3.1 Permanently mount computer. You should mount the parts (sensors, relays, etc.) that will be used for your engine at this time.
- 5.3.2 Mold harness groups to the connectors of the engine, frame and etc. Remember to route the harness away from sharp edges, exhaust pipes, hinges and moving parts.
- 5.3.3 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.

- 5.3.4 When used every 1 1/2" or so on the visible areas of the harness, 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.

5.4 Terminal installation instructions

Note: In the following steps you will be making the circuit connections for the fuel pump, A/C compressor, Ignition and electric fan relay ground. Before you start, you should carefully read Sections 6.0 through 7.0, as applicable, and continually refer to the wire connection charts, DOUBLE CHECKING your length connections. These directions are for the wires which do not have a connector already installed on them.

- 5.4.1 Have all needed tools and connectors handy.
- 5.4.2 Select the correct terminal for the wire and application.
- 5.4.3 Determine the correct wire length and cut the wire. Remember to allow enough slack in the harness and wires at places where movement could possibly occur.
DOUBLE-CHECK YOUR CALCULATIONS.
- 5.4.4 Strip insulation away from wire. Strip only enough length necessary for the type of terminal you are installing.

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

- 5.4.5 Crimp the terminal onto the wire.
- 5.4.6 Connecting the wires and connectors throughout the harness is a repeating process. Make sure that each wire is first properly routed and then attached. **DO NOT ATTACH AND THEN ROUTE AFTERWORD.**
- 5.4.7 When all wires are attached, tighten the mounts and ties to secure harness permanently.
- 5.4.8 Attach the connectors to the computer **BEGIN CAREFUL NOT TO BEND ANY PINS**
- 5.4.9 Only 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.

6.0 GM LS-1 SYSTEM WIRING HARNESS INSTALLATION INSTRUCTIONS

6.1 Dash Section Installation

The wires in this group consist of the assembly line diagnostic link (ALDL) connector, the check engine light, ignition and tach wires (pre-mounted into a mounting bracket and four other wires).

CAUTION: Do not make any connections when the harness is plugged into the computer

Note: Wire color (example: BK/WT) is one wire with a stripe. The second color (The stripe) may not be bold. Observe all two-color wires closely.

- A. Find a suitable location to mount the ALDL connector that will allow access to the front Of the connector and still allow you to see the “check engine” light while driving.
- B. Mount the ALDL connector.
- C. Locate the Pink wire and attach it to the fuse block or the coil power wire. **POWER IS REQUIRED WHEN THE KEY IS IN THE RUN AND START POSITION.** This is the ignition power wire for the ECM.
- D. Locate the Tan/Black wire labeled ALT.FUEL. If you are running a Camaro/Firebird engine with stock 26.5 LB/HR injectors ground this wire to the chassis. If you are running a Corvette engine with stock 29 LB/HR injectors do not ground this wire. When running the Corvette style injector be sure to isolate this wire by crimping a red butt splice onto the wire. This is to prevent the wire from becoming grounded. If you are running the 29 LB/HR injectors in a Camaro engine **DO NOT USE THIS WIRE.**
- E. Locate the GRN wire labeled FAN #1 and attach this wire to your electric fan relay ground (if available). This wire will send ground reference to the fan relay.

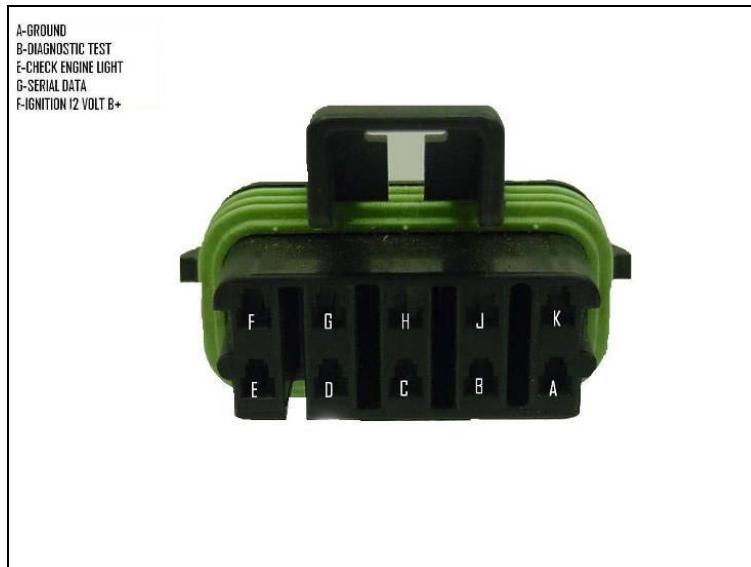


Figure 6.1 Assembly Line Diagnostic Link Connector (ALDL)

6.2 SENSOR AND RELAY GROUP INSTALLATION

Note: If you have not already done so, read Sections 4.0 and 5.0 of these instructions and think through the installation of the harness before securing or cutting any wires.

6.2.1 Sensor and Relay Installation

Note: The single RED wire with the female terminal that comes out of the fuel pump and ignition relay base is a test lead only. It is not connected to anything. See note in Section 7.1

The three relays that have been supplied for you in the kit are for the following:

Fuel Pump Relay	This relay will supply the 12 V ignition hot power to your fuel pump when the key is on and in start.
A/C Signal Relay	This relay will supply a ground for the computer to increase engine RPM when the A/C compressor has been activated.
Ignition Relay	This relay will supply 12 V ignition hot power to the O2 sensor, check engine light and computer when the key has been turned to on or start position.

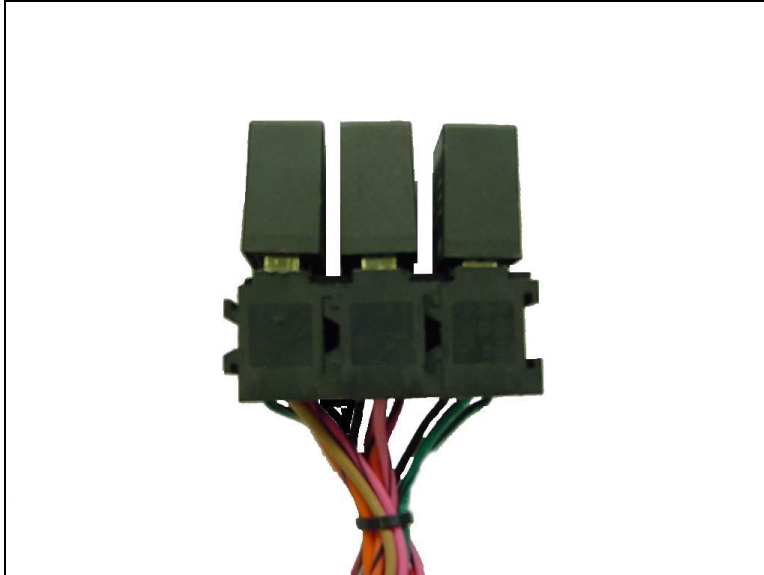


Figure 6.2 65106 Relays and Relay Bases

Note: You will have to install the relays in their housing after mounting the relay bases. All three relays are identical.

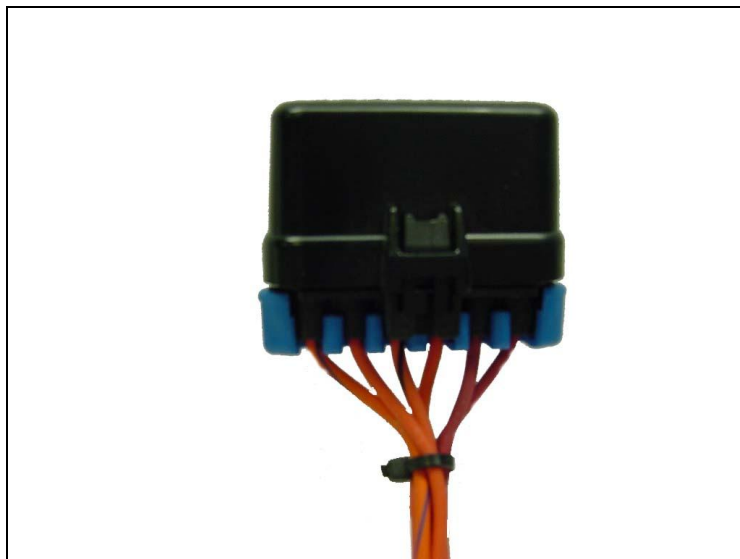


Figure 6.3 65106 Fuse Block

6.3 ENGINE GROUP INSTALLATION

The engine group is designed to be separated into the left side (driver) and the right side (passenger) sections. Each side is tie wrapped separately, BUT NOT LABELED. The right side of the engine has the connector for the IAC, TPS and ECT all of which ARE labeled. First separate the engine group into the left and right side sections and place them accordingly.

- 6.3.1 Before you connect any wires, separate the fuel pump and coil B+ wire from the engine group and place it out of the way.
- 6.3.2 Locate the two separate ring terminal grounds (labeled GRND#1 and GRND#2) in the harness. Place these wires on a ground source or engine bolt.
- 6.3.3 Using **Figure 6.4** and **Table 6.1** connect the wiring as directed.
- 6.3.4 Locate the PINK wire labeled COIL B+, connect this wire to a IGN. 12 V source that gets power in both start and run.

Wire Colors	# of Positions in Connector	Labeled	Connects to:
Blue, Lt. Blue	2	KNOCK	Knock Sensor
Bk/Wt, Pur.	4	OXY.	Oxygen Sensor
Blk. Pk/Bk			
Bk/Wt, Lt. Grn.	3	MAP	MAP Sensor
Gray			
Bn/Wt, Rd/Bk	3	CMP	Cam Position
Yw/Bk			
Yel., Yw/Bk	3	CKP	Crank Position
Rd/Bk			
Pk/Bk, Blue	2	Inj #1	Injector # 1
Pk/Bk, Green	2	Inj. #2	Injector # 2
Pk/Bk, Green	2	Inj. #3	Injector # 3
Pk/Bk, Blue	2	Inj # 4	Injector # 4
Pk/Bk, Green	2	Inj # 5	Injector # 5
Pk/Bk, Blue	2	Inj # 6	Injector # 6
Pk/Bk, Blue	2	Inj #7	Injector # 7
Pk/Bk, Green	2	Inj #8	Injector # 8
Bk/Wt, Blue	3	TPS	TPS Sensor
Gray			
Bk/Wt, Yel.	3	ECT	ECT Sensor
Green			
Bk/Wt, Tan	2	IAT	IAT Sensor
Lt.Grn/Bk, Lt.Bl./Bk.	4	IAC	IAC Sensor
Lt.bl/Wt, Lt.Grn/Wt			
Pur., Red, Green, Lt. Blue	7	Drvr. Coils	Driver Side
Brown, Bk/Wt, Pink			Coils
Rd/Wt, Pur./Wt, Lt. Bl/Wt	7	Pass. Coils	Passenger Side
Gr/Wt, Bk/Wt, Blk, Pink			Coils
Blk., Bk/Wt		GRND # 1 & # 2	Engine Ground
Red		Starter B+	Starter B+
			Term.
Pink		Coil B+	Ign. Hot 12V
Tan/Blk		Alt. Fuel	Ground for F- Body engines

Table 6.1 GM LS-1 Engine Group Connections

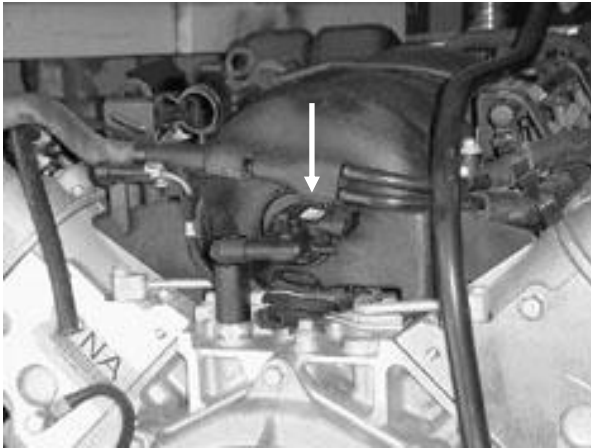


Figure 6.4 MAP Sensor

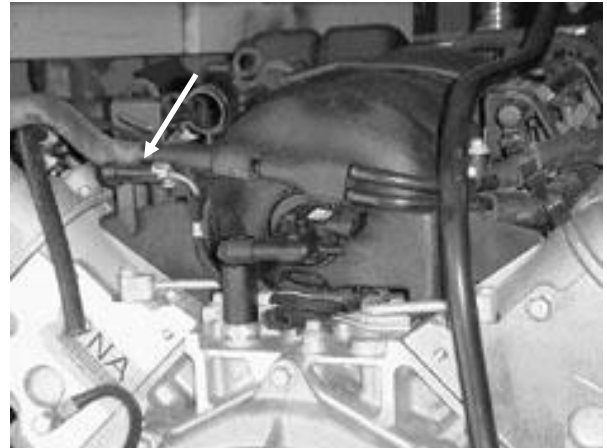


Figure 6.5 Knock Sensor

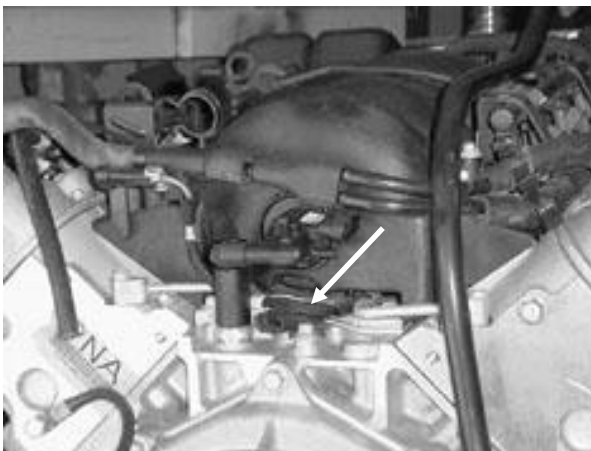


Figure 6.6 CMP Sensor

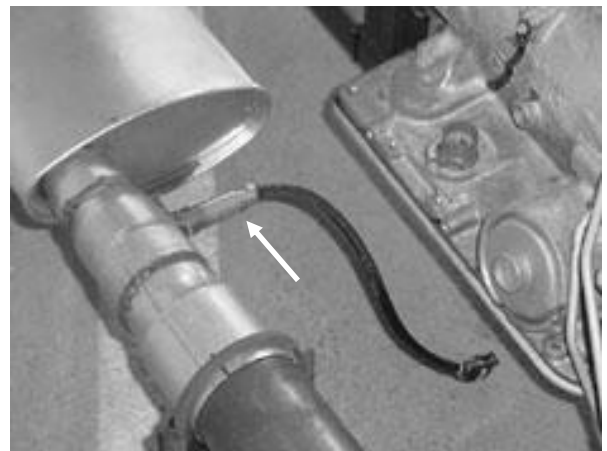


Figure 6.7 Oxygen Sensor

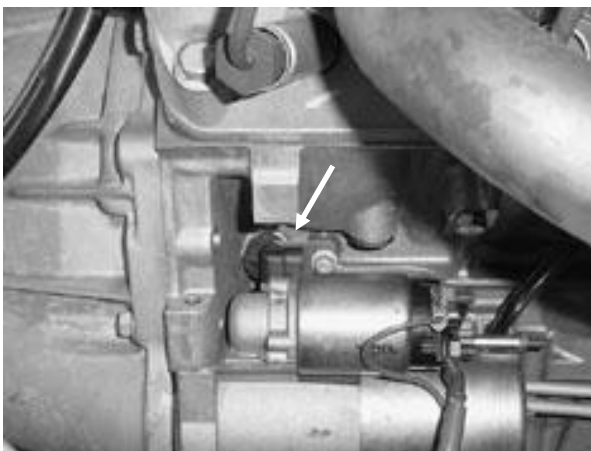


Figure 6.8 CKP Sensor

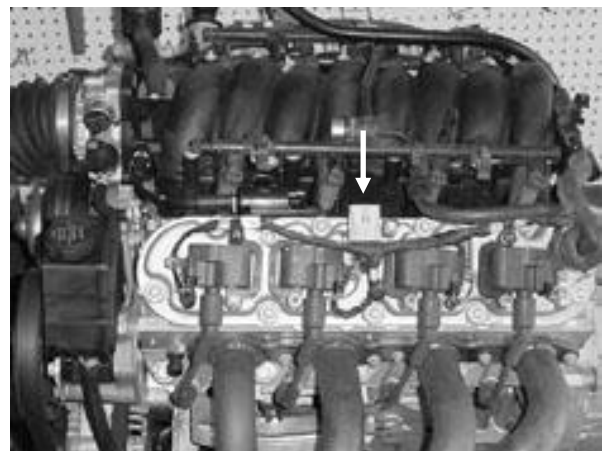


Figure 6.9 Drivers Side Coil

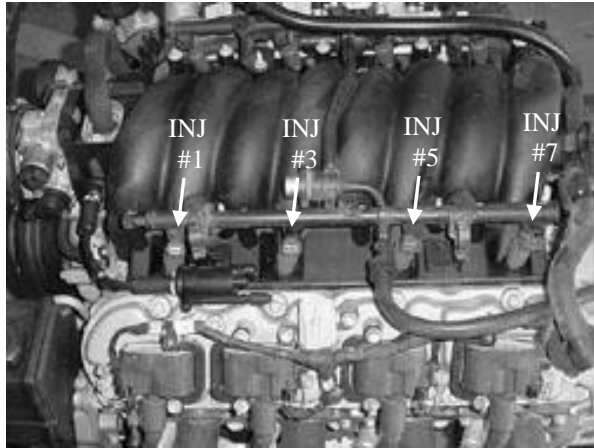


Figure 6.10 Drivers Side Inj.

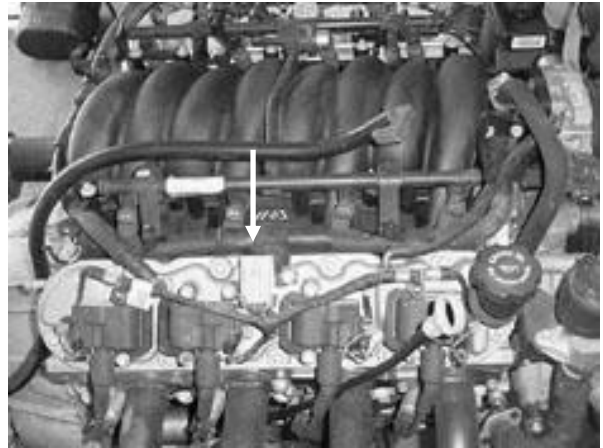


Figure 6.11 Pass. Side Coil

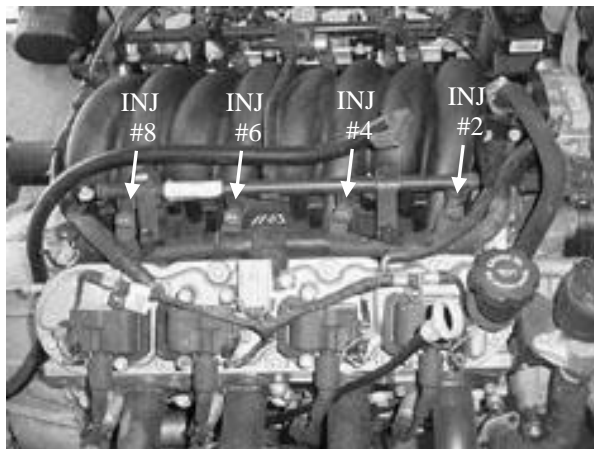


Figure 6.12 Pass. Side Inj.

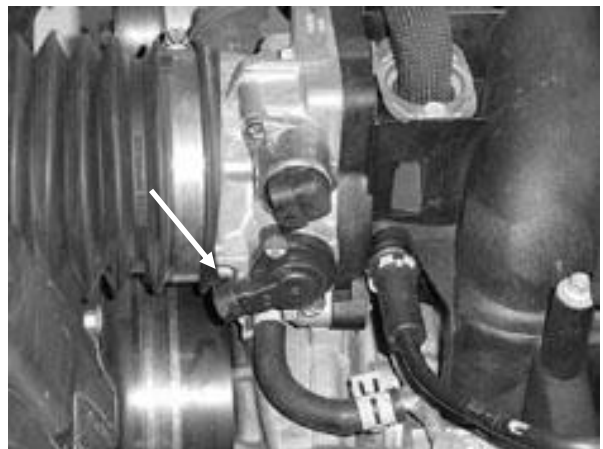


Figure 6.13 TPS Sensor

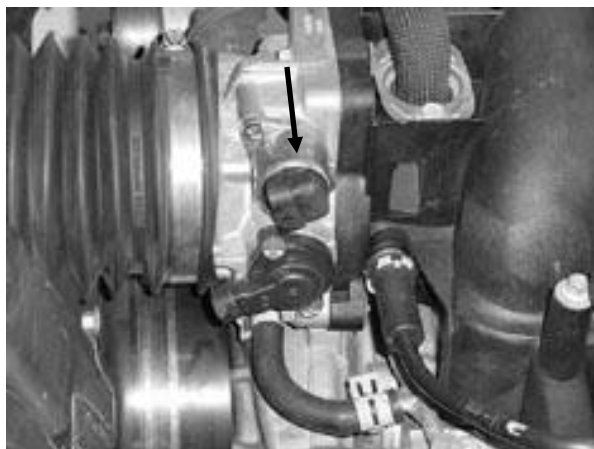


Figure 6.14 IAC Sensor

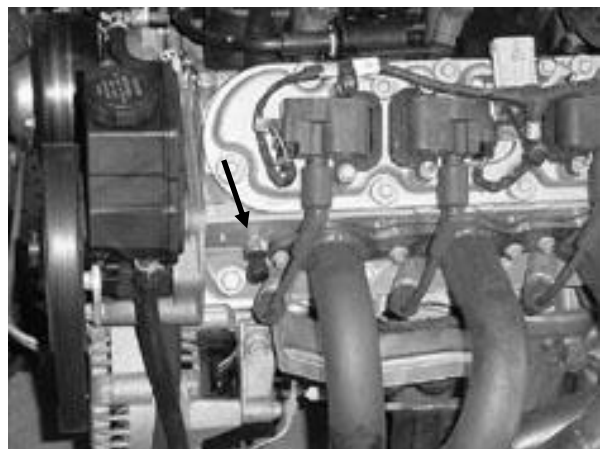


Figure 6.15 ECT Sensor



Figure 6.16 IAT Sensor

7.0 TROUBLE SHOOTING INSTRUCTIONS

Note: Only scanners with marine cartridges and marine cable plugs will communicate with the PERFECT computer.

If you are having trouble with your engine running badly or not at all, first perform basic trouble shooting(checking for faulty connections, spark, fuel pressure, etc.) then see if the computer has stored any trouble codes in its memory.(See 7.3 and 7.4)

7.1 THROTTLE POSITION SENSOR ADJUSTMENTS

Once you have installed the kit and are ready to start the engine for the first time you must first readjust the voltage that is going the Throttle Position Sensor.

- A. Turn on ignition but do not start engine.
- B. Check to insure throttle is not depressed.
- C. At the throttle position sensor, place a digitalis voltmeter's probes into the blue and black wires in the back of the sensors connectors, which is plugged into the sensor.
- D. Find the throttle stop screw that is located on the passengers side of the housing.
- E. Re-adjust the screws until your volt meter reads .8volts.

We are having you re-adjust the TPS to eliminate the chances of a stalling issue in long deceleration while driving. You should not have to worry about this issue, but if it occurs double check the voltage coming out of the TPS blue wire, and make adjustments accordingly.

7.2 THE FUEL PUMP RELAY CHECK

The small RED wire that is coming out of the relay is a TEST lead wire. If you do not hear your fuel pump prime when you turn on the ignition take a jumper wire and connect it from a 12 V power source to the RED wire coming our of the FUEL PUMP RELAY. By supplying 12 V to that wire you are bypassing the relay completely. You should hear the pump run. If you do not hear anything, make sure that all connections are good and the pump has a sufficient ground.

7.3 THE CHECK ENGINE LIGHT

Normally, the “check engine” light should come on when the ignition is initially turned on, and then go out a few moments after the engine starts running. If the computer has detected a problem and a trouble has been set the light will come back on.

7.3.1 The computer identifies particular trouble codes by flashing the “check engine” light in a certain way. The codes are read by counting the flashes:

- A: The first digit (the “tens” digit) of the code is flashed quickly, followed by a brief pause, then the second digit (or “ones”) is flashed, followed by a longer pause. For example, (3) three quick flashes followed by a brief pause followed by a two (2) flashes indicate code 32.
- B: The code will repeat itself two (2) times. The next code if any will be displayed in the same manner.

Note: When you access the codes from the computer a code 12 (one flash followed by two flashes) will first be displayed. **THIS DOES NOT INDICATE A PROBLEM.** Code 12 will be flashed 2 times, followed by the particular trouble codes, if any. If the computer merely flashes code 12 there are no trouble codes stored. Code 12 means the engine is not running.

7.4 RETRIEVING TROUBLE CODES FROM THE COMPUTER

7.4.1 In order to retrieve the trouble codes stored in the computer, locate the ALDL plug installed in **Section 6.2**. Turn the ignition on, **BUT DO NOT START THE VEHICLE**. Connect a jumper wire from the ALDL terminal “A” to terminal “B” see **Figure 6.1** and observe the check engine light.

7.4.2 After you have read any codes (remember the normal code 12) write them down for reference. Remove the jumper wire from the ALDL connector.

7.4.3 Take the codes one at a time and match them to the codes in **Table 7.1**. This will tell you in which circuit the computer has detected a problem.

Note: A code indicates a problem is a specific circuit, **NOT THAT A PARTICULAR PART IS BAD.**

7.4.4 Before taking more extensive corrective actions for any trouble codes, make sure that all connections on the indicated circuit, **INCLUDING THE COMPUTER**, are clean and tight. Inspect the wiring in the circuit for any broken, shorted, or exposed wires. Finally, insure all grounds wires are clean and secure.

7.4.5 If you are getting a code from your computer and need to clear the code, other than code 12, after you have replaced apart, readjusted a part, etc. You can do this by making the following steps:

- A: Install a jumper wire from terminal A to terminal B
- B: Ignition ON engine OFF
- C: Move throttle from 0% (idle) to 100% (WOT) and back to 0%
- D: Remove the jumper wire
- E: Turn ignition OFF for at least 20 seconds
- F: Ignition ON engine OFF
- G: Recheck for codes

CODE # CIRCUIT AFFECTED	
13-----	Oxygen Sensor Inactive
14-----	Coolant Sensor High Voltage (COLD)
15-----	Coolant Sensor Low Voltage (HOT)
21-----	Throttle Position Sensor (high voltage)
22-----	Throttle Position Sensor (low voltage)
23-----	Manifold Air Temp. (low temp.)
25-----	Manifold Air Temp. (high temp.)
33-----	MAP Sensor Circuit (high voltage)
34-----	MAP Sensor (high voltage)
41-----	EST Fault
42-----	EST/BYPASS fault
44-----	Knock Sensor inactive
51-----	Calibration checksum
54-----	Oxygen Sensor (lean reading)
55-----	Oxygen Sensor (rich reading)
81-----	TPS (out of range)

Table 7.1 Diagnostic Trouble Codes Chart

7.5 WHEN TO CALL PERFECT PERFORMANCE TECH LINE

- 7.5.1 This harness kit has been built with the highest regard to strict quality control and tested before shipment. Before calling us please double-check all connections and perform normal basic trouble shooting (fuel pressure, ignition power and spark, etc.)
- 7.5.2 If you have any questions concerning the installation of this harness or are having trouble in general; feel free to call Painless Performance tech line @ 800 423-9696. Calls are answered from 8AM to 5 PM CST, Monday-Friday, except holidays. Please leave a message if you are unable to reach us and we will return your call as soon as possible.

Note: Helpful information on the PERFECT PERFORMANCE ECM Calibration

The PERFECT ECM has been specifically calibrated for you particular engine. This computer will not work with any other type of engine, nor will it work with a modified engine (i.e. aftermarket parts). The computer has also been programmed to control your electric fan.

Painless Performance Limited Warranty and Return Policy

Chassis, 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.