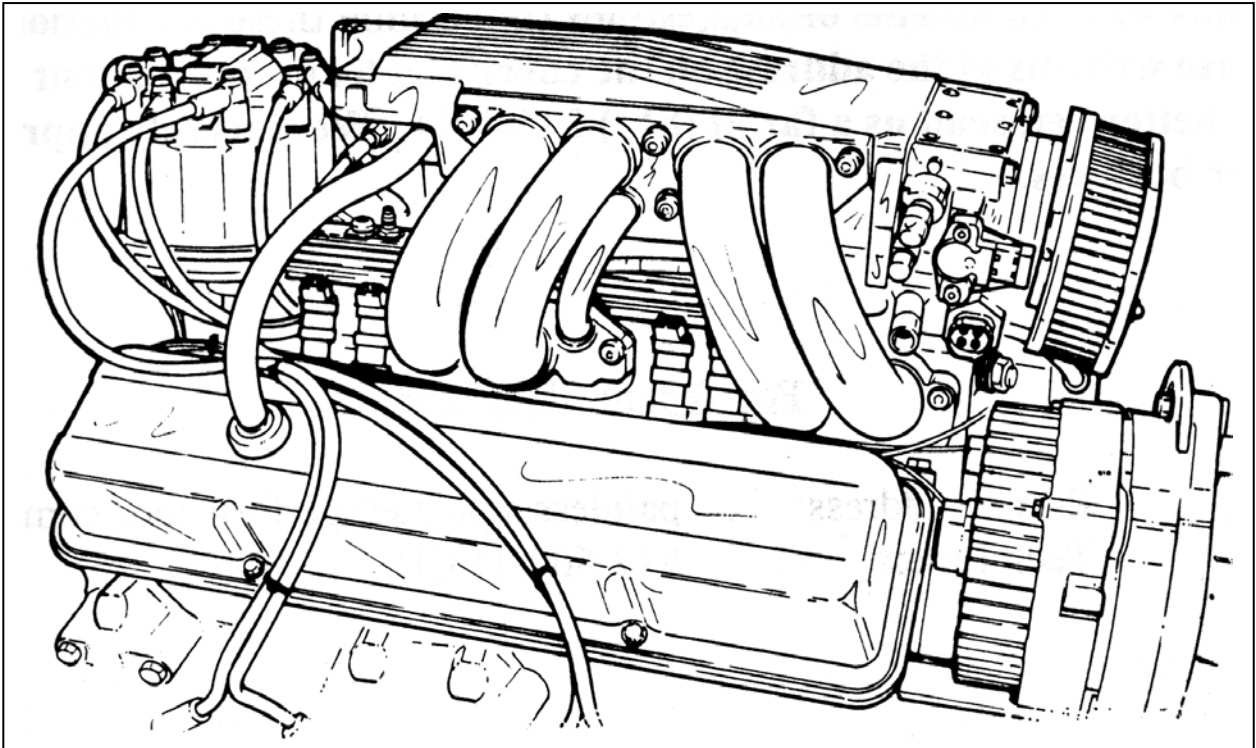




Wire Harness Installation Instructions

For Installing:

- Part #60102 - GM 86-89 TPI Mass Air Flow (MAF) Standard Harness
- Part #60103 - GM 90-92 TPI w/Speed Density (MAP) Standard Harness
- Part #60202 - GM 86-89 TPI Mass Air Flow (MAF) Extra Length Harness
- Part #60203 - GM 90-92 TPI w/Speed Density (MAP) Extra Length Harness



Manual # 90534

1.0 INTRODUCTION

You have purchased what we at Perfect Performance Products, Inc. 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 tuned port (5.0L and 5.7L) injection engines. This includes all wiring that is needed by the computer to run and control the fuel injection system.

Most of the wiring in the harness has been pre-terminated to the proper connector and all wire is rated at 125°C and has been GM color-coded.

These fuel system harnesses have been divided into three major groups:

ENGINE GROUP Includes wiring for the fuel injectors, distributor, sensors and tail section.

DASH GROUP Includes ignition feed wire, assembly line diagnostic link (ALDL) connector, check-engine light, gearshift position wiring and brake switch wire.

2.0 ABOUT THESE INSTRUCTIONS

These instructions provide information for the installation of the 60102 and 60202 Tuned Port Injection Wire Harness Kit (for MAF TPI's), and the 60103 and 60203 Tuned Port Injection Wire Harness Kit (for MAP TPI's). 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 Specific Circuit Instructions
- 7.0 Early Version TPI (Mass Airflow) Instructions 60102 / 60202
- 8.0 Late Version TPI (Map Sensor) Instructions 60103 / 60203
- 9.0 Pre Adjustments Before Starting Engine
- 10.0 Trouble Shooting Instructions
- 11.0 Add on Early TPI Emissions
- 12.0 Add on Late TPI Emissions

Sections are further divided into **Paragraphs** and **Steps**. Throughout, the **Figure** numbers refer to illustrations 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	<i>Note: Use a quality tool to avoid over-crimping.</i>
Wire Stripper	
Continuity Tester	<i>Caution: Do <u>not</u> use a test light to test the computer or sensor wiring or you will damage the computer.</i>
Electric Drill	
1-1/4" Hole saw	(for the 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 automobile. That depends a great deal upon the particular make of automobile and to what extent you want to secure and conceal the harness. We do offer some general guidelines and routing practices starting in **Paragraph 4.3**, GENERAL installation instructions in **Section 5.0**, and precise instructions 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:

4.1 VEHICLE SPEED SENSOR AND TRANSMISSION LOCKUP FUNCTIONS

Before you install the harness, please decide the following things:

- a. Are you going to use a 700 R4 Lockup Transmission that you want the computer to control the lockup on?
- b. Does the engine have to be emissions legal; i.e. does the EGR valve and /or air solenoid, and diverter valve need to be connected

If you answered yes to either or both of these questions then you must connect the wires labeled VSS to a vehicle speed sensor that will provide a two (2) or four (4) pulse signal to the computer. On the early model tuned port the sensor should output a square wave and on the late model tuned port engines it should provide a sine wave output. Painless Wiring offers a VSS for either application, that will allow you to use your cable drive speedometer (if applicable)

If you answered no to both of these questions then you may choose not to use a vehicle speed sensor. Please note, there is the possibility of drivability issues, unless the VSS is installed.

If you are going to use a vehicle speed sensor, take the orange/black and black/white wires in the dash section (labeled for the park/neutral indicator switch) and connect them to the Park/Neutral Indicator Switch, **which is designed to tell the computer the transmission is in park**, as instructed in 6.1.4, and Figure 6.5. Do not connect the wires together.

Important: *The orange/black and black/white wires in the dash section that are labeled for the park/neutral indicator switch are to be connected to the **park/neutral indicator switch**, **NOT A NEUTRAL SAFETY SWITCH**. Under no circumstances should you connect these wires to a neutral safety switch. (A park/neutral indicator switch is a switch that tells the computer when the vehicle is in park or neutral, but a neutral safety switch is a switch that keeps the vehicle from starting unless it is in park or neutral.) You should never connect the orange/black and black/white wires to the vehicle speed sensor wiring.*

If you are not going to use a vehicle speed sensor then you will take the orange/black and black/white wires in the dash section (labeled for the park/neutral indicator switch) and connect them together.

- 4.1.1** If you do NOT wish to use the lockup function, tape off and store the single purple wire, marked brake switch, in the dash group and the 4-position square connector in the tail section.
- 4.1.2** If you ARE going to use the lockup circuit then you MUST have a vehicle speed sensor (VSS) and the correct brake switch. These are necessary to make the lockup function 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. The vehicle speed sensor lets the computer know how fast the wheels are turning.
- 4.1.3** Regardless of whether you use the lockup function, the vehicle speed sensor (VSS) must be used and is needed by the computer so that it can command the emissions control devices on the engine. This part is necessary if you want your vehicle to be street-legal.
- 4.1.4** There are two different VSS harness applications. Early TPI has a single brown wire that attaches to one of the two wires coming out of the 60115 speed sensor and the other wire is connected to ground. The Late TPI has two wires, purple and yellow that goes to and attaches to the 60116 sensor from the computer.

4.2 You should get to know the particular engine that you are using:

- **EARLY VERSION TUNED PORT INJECTION (TPI) SYSTEM WITH A MASS AIRFLOW (MAF) SENSOR:** The 60102 and 60202 harness will support the mass airflow (MAF) sensor, the burn off circuit wiring, and the electronic spark control (ESC) module in addition to the other wiring common to the tuned port systems.
- **LATE VERSION TUNED PORT INJECTION (TPI) SYSTEM WITHOUT A MASS AIRFLOW (MAF) SENSOR, DESIGNED TO USE A MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR, BUT DOES NOT REQUIRE AN ELECTRONIC SPARK CONTROL (ESC) MODULE:** The 60103 and 60203 harnesses are designed for and will support this system. This system has three connectors at the computer instead of the two connectors shown in **Figure 4.1**.

Note: Computer chips, on the later model (late 89 and up) tuned port engines all factory chips have the vehicle anti-theft system (VATS) programmed into them so that they cannot be used unless the factory steering column, compatible with the computer, was installed. For the late model tuned port only you must obtain an aftermarket chip that does not have the VATS programming in it.. For the late model tuned port systems, you will need to obtain a chip for a 1991 Camaro with the VATS system removed so that it will be compatible with our harness. Also, GM started using the VATS system in late 1989 so if you are using an 1989 chip on an early style tuned port motor then please be careful to use a chip that does not have the VATS programmed into it.

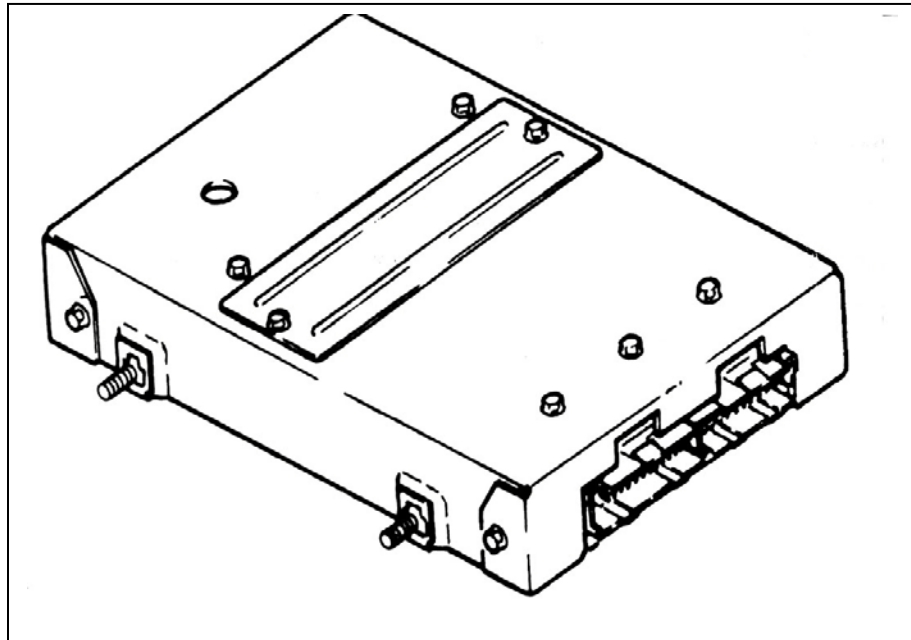


Figure 4.1 Fuel Injection Computer

4.2.1 The Painless Harness is designed to be used with specific sensors and relays. See **Table 4.1 on page 7**. These will meet all requirements and are compatible with Painless Performance harnesses. The following numbers given are GM part numbers except for the vehicle speed sensor (VSS) which is a Painless Performance number. The main computer part numbers are REQUIRED for use with our harnesses. *Note: Distributor to Coil and the Coil Power/Tach Pigtail are used only if you have a “separate coil” distributor.*

The computer part numbers shown in the compatible parts list in **Table 4.1** are required part numbers for that application. The use of any other computer may damage the computer, harness or both. Use of the wrong computer will almost certainly cause problems. Please double check to be sure that you have the correct computer part number (it is shown as a service number on the computer itself). The rest of the part numbers shown are for your information only.

4.2.2 If you are using a separate coil type distributor, then you will use the distributor adapter included in the kit. You will also need to obtain the distributor to coil and coil power/tach pigtails either from your local dealer, a wrecking yard or from the original harness. The wiring for the separate coil system is shown in **Figure 4.2**.

- 4.3** Familiarize yourself with the harness by locating each of the harness groups and by looking at the connectors on the wire ends.
- 4.4** Decide where and how the computer and sensors will be mounted. Painless Performance wire harness kits are designed to mount either under the dash or in the lower kick panel on the right side. They must be no further apart than the wiring will allow (approx. 10 inches). Part numbers 60202 and 60203 will allow installation under the front seat.
- 4.5** 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.
- 4.6** 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.
- 4.7** Route the harness away from sharp edges, exhaust pipes, and the hood, trunk, and door hinges.
- 4.8** Plan where harness supports will be located. Use a support approximately every 6 inches unless the harness routes under the floor carpet.
- 4.9** Allow enough slack in the harness at places where movement could possibly occur (body to frame, frame to engine, etc.).
- 4.10** The wires should be bundled into harness groups. Use tape, nylon ties or poly-split loom.

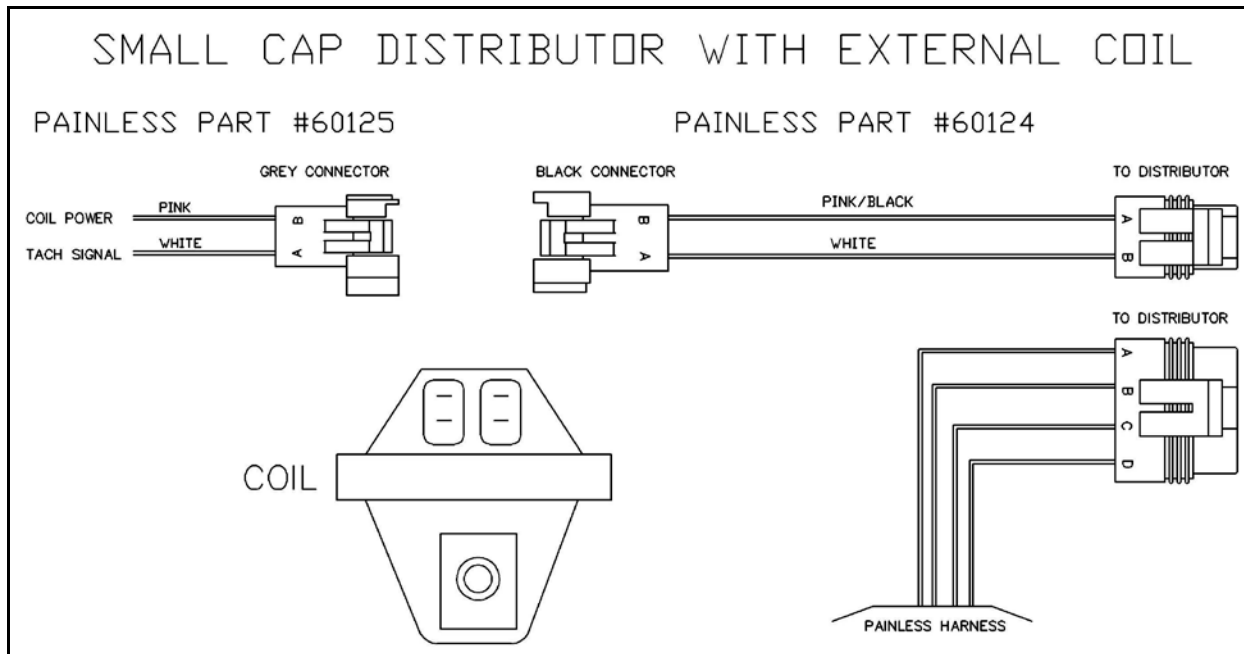


Figure 4.2 External Coil Distributor Hook-up

MAF Tuned Port Injection 60102 & 60202

Main Computer.....	1227165 or 16198259
Brake Switch.....	25524845
Neutral Safety Switch.....	15705308
Electronic Spark Control Module.....	16128261
Manifold Air Temp.....	25036979
Knock Sensor.....	10456018
Oxygen Sensor.....	AFS 21
Mass Airflow Sensor.....	14094712
Mass Airflow Power Relay.....	10067925
Mass Airflow Burn Off Relay.....	10094701
Oil Pressure Switch.....	25036553 or D1818
Vehicle Speed Sensor.....	PPP 60115
Distributor to Coil Wiring.....	PPP 60124
Coil Power/Tach Pigtail.....	PPP 60125
EGR Solenoid.....	1997111 or 214-331 **
Manifold Air Temp.....	25036979
Non-Vats Prom (85-88 5.0L engines)...	16082183
Non-Vats Prom (85-88 5.7L engines)...	16068654

MAP Tuned Port Injection 60103 & 60104

Main Computer.....	1227730 or 16198262
Brake Switch.....	25524845
Neutral Safety Switch.....	15705308
Manifold Absolute Pressure Sensor.....	16137039
Coolant Temperature Sensor.....	25036979
Knock Sensor.....	10456126
Oxygen Sensor.....	AFS 21
Oil Pressure Switch.....	25036553 or D1818
Vehicle Speed Sensor.....	PPP 60116
EGR Solenoid.....	1997111 or 214-331 **
Distributor to Coil Wiring.....	PPP 60124
Coil Power/Tach Pigtail.....	PPP 60125

* Note: This Prom does not control any transmission or torque converter functions.

** This part has been discontinued by GM and is for reference only. The new replacement is a 214-339, Available thru your local Delco Distributor. Call Painless for the adapter pigtail needed for this unit

Table 4.1 Compatible Parts

5.0 GENERAL INSTALLATION INSTRUCTIONS

Caution:

- *Do not disconnect the battery or the 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!

When routing the wires for the vehicle speed sensor (if used) make certain that they are at least 12 inches away from any ignition wiring (spark plug wires, etc.).

Notes:

- All of the adapters, listed in the manual, are included in the wiring kit. You should use or remove them depending on your particular application.
- If you are switching a TPI engine from MAF Sensor to MAP Sensor then you must use the new Knock Sensor in **Table 4.1**.
- An oil pressure SWITCH must be used with this harness. **DO NOT BYPASS OIL PRESSURE SWITCH WIRES.**
- If you are using an oil pressure switch that has two or three small pins surrounded by a plastic collar for an electrical connection, an adapter is in the kit.
- 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. **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.
- IF YOU HAVE A GM SEPARATE COIL IGNITION SYSTEM ON YOUR ENGINE: use the adapter in the kit.
- FOR YOUR DISTRIBUTOR: The power wire used on the previous distributor should work fine as long as there is no ignition resistor in the circuit. It **must** be a **fused** power wire (14 ga. minimum) that is HOT (+12V) when the ignition switch is in the **START AND RUN** positions. Connect it to the terminal on the distributor cap labeled BAT or to the pink wire on the separate Coil Ignition System. This wire provides power to the ignition coil. **YOUR AUTOMOBILE WILL NOT START OR RUN WITHOUT IT.**
- The connector for ignition timing adjustment is located near the computer connection. This is a black plastic connector in the tan/black wire
- The fuel pump you are using **MUST** be rated at a minimum of **45 pounds PSI** (per square inch) for tuned port systems.
- If you have headers you may have to relocate the knock sensor for proper clearance. See **Figure 6.9**.

Note: The oil pressure switch wires are designed to be connected to an oil pressure switch, not the oil pressure sending unit. An oil pressure sending unit is for a gauge or an indicator light and will only have one terminal on the top. The stock oil pressure switch is cigar shaped and has three terminals. If you wish to use the stock oil pressure switch then you will use the oil pressure switch adapter included with this kit. On the oil pressure switch adapter there are two wires that match the wire colors coming from our harness and there is also an extra wire.

The extra wire is for the factory oil pressure gauge or indicator light, depending on what the switch was originally designed for. You may also obtain a smaller oil pressure switch if you have clearance problems with the original oil pressure switch. This type of switch has two male connectors that will plug directly into the harness.

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 of installing a quality wire harness only to neglect proper grounding.

- 5.1.1** Connect a ground strap or cable (minimum of a 2-gauge wire) from the negative battery terminal to the engine block.
- 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 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.*

- 5.2.1** Position the computer and sensors in their intended locations.
- 5.2.2** Drill a 1-1/4" hole for the firewall grommet near the computer for the engine group and tail section to pass through.
- 5.2.3** 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.
- 5.2.4** Route the dash group over to the driver's side of the car.
- 5.2.5** Route the sensor group to the area where the sensors will be mounted.

5.3 HARNESS ATTACHMENT

Note: *Harness routing and shaping is, and should be a time-consuming task. Taking your time will enhance the reliability and appearance 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. These parts will vary by application.

- 5.3.2 Mold harness groups to the contour of the dash, engine, frame, 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. Before you start, you should carefully read Sections 6.0 through 8.0, as applicable, and continually refer to the wire connection 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.*

- 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 using.

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 attach. **DO NOT ATTACH THEN ROUTE AFTERWARD.**
- 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 **BEING 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 SPECIFIC CIRCUIT CONNECTIONS

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.

6.1 DASH SECTION INSTALLATION

The wires in this group consist of the assembly line diagnostic link (ALDL) connector (See **Figure 6.3**), the check engine light (pre-mounted into a mounting bracket), and four other wires.

Note: You may need to connect the check engine light wires to their mates in the wire harness.

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.

6.1.1 Find a suitable location to mount the ALDL connector (using the bracket that the check engine light is mounted in) that will allow access to the front of the connector and still allow you to see the check engine light while driving.

6.1.2 Mount the ALDL connector.

6.1.3. Locate the Pnk/Blk wire and attach it to a 12V **fused** power source. **POWER IS REQUIRED WHEN THE KEY IS IN THE RUN AND START POSITION.** This is the power wire for the computer.

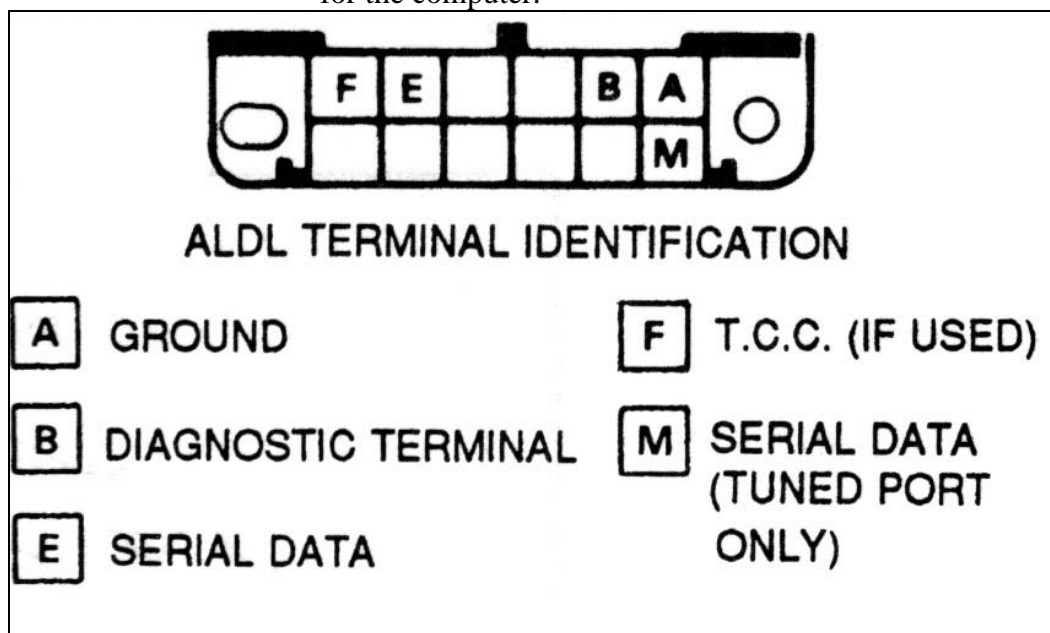


Figure 6.3 Assembly Line Diagnostic Link (ALDL) Connector

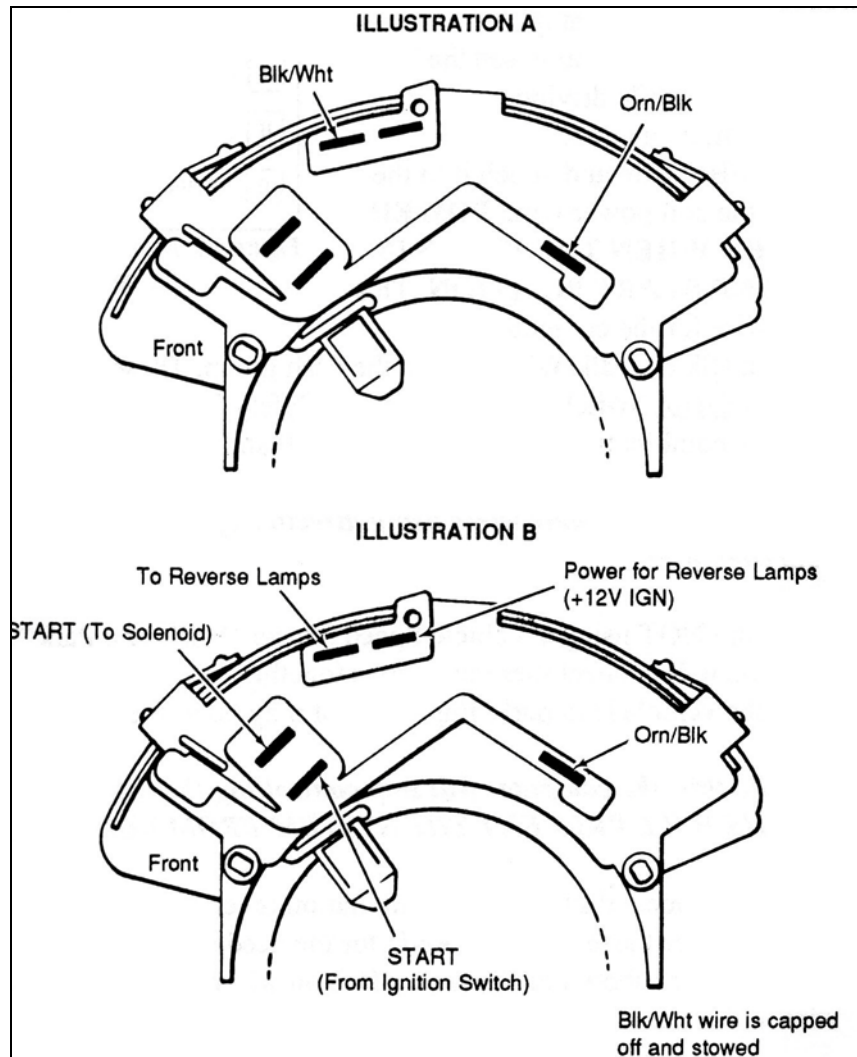


Figure 6.4 A & B Neutral Safety Switch

- 6.1.4** Locate the Orn/Blk and Blk/Wht wires in the dash group. These two wires are for the Park/Neutral Selector Switch, NOT the Neutral Safety Switch. If you have a GM column then you can use the combination switch P/N 15679680 and wire it as shown in **FIGURE 6.4**.

Caution: *Do not connect these wires using directions from different instructions. You may damage the computer.*

- 6.1.5** If you are NOT using a Vehicle Speed Sensor (VSS) or a Park/Neutral Indicator Switch then you will connect these two wires together (orn/blk and blk/wht). When this is done, the computer will think the vehicle is in park. Engine RPM may be limited by the computer!

Note: *If you do this, the computer will stop controlling the exhaust gas recirculation (EGR) solenoid. THIS WILL PREVENT THE SYSTEM FROM BEING STREET LEGAL*

6.1.6. The recommended switch is a combination reverse light AND neutral safety switch. You may use it for these purposes AND for the needed computer signal. If you wire it EXACTLY as shown in **Figure 6.4B**. You will need to tape off and store the Blk/Wht wire in this case.

6.1.7. If you are going to use the recommended switch for the computer's benefit ONLY, then you will wire it as shown in **Figure 6.4A**.

6.1.8 You may install your own switch. This switch must connect the Orn/Blk wire to ground ONLY when the car is in PARK. You may or may not want to use the Blk/Wht wire. The other end of the Blk/Wht wire is already connected to ground through the harness.

Note: Not attaching the orn/blk wire to anything may turn on the check engine light

6.1.9 The single purple wire is the wire that powers the lockup function on the transmission. If you ARE NOT using the lockup then you will tape off and store this wire. If you ARE using the transmission lockup function then you will have to install a vehicle speed sensor and a brake switch as described in **Paragraph 4.1.2**.

6.1.10. If you are using the recommended brake switch then you will wire it according to **Figure 6.5**. The wire jumped 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 you have installed your own switch then it must connect the single purple wire to power ONLY when the brakes are NOT being applied. If you are using a hydraulic brake switch see page 33 for proper wiring using a relay.

Caution: Failure to wire this switch correctly will result in a dangerous situation on the vehicle.

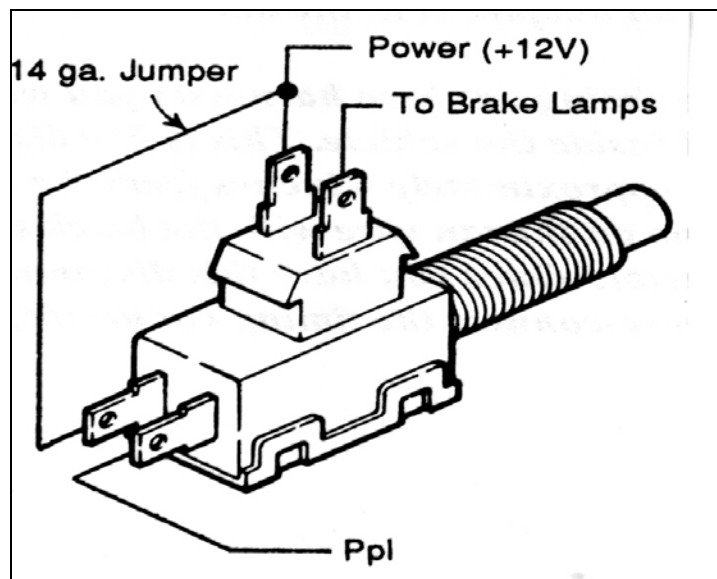


Figure 6.5 Brake switch

6.2 SENSOR AND RELAY INSTALLATION

- A. Take the wiring that was previously routed to the sensors and connect it according to **Table 6.2**

Color	# of Positions In Connector	Labeled	Connect to:
Blk/Wht(1), Orn, Dk.Grn/Wht, Red, Gry or Tan/Wht	5	----	Fuel Pump Relay (Style 1) (This connector has the short red lead on it)
Blk/Wht,Orn,Dk.Grn/Wht, Gry or Tan/Wht	4	-----	Fuel Pump Relay (Style 2)
Lt.Grn, Gry, Pur or Blk	3	MAP ^{2,3}	Manifold Absolute Pressure Sensor
Red, Dk.Blu, Blk/Wht, Orn, Tan/Wht	5	MAF (P) ²	Mass Airflow Power Relay
Dk.Blu, Blk, 2x Orn	4	MAF (B) ²	Mass Airflow Burn off Relay
Blk, Brn, Pnk/Blk, Blu	5	ESC ^{2,3}	Electronic Spark Control Module

Notes:

1. On striped wires (example: Blk/Wht), the second color (stripe) may not be bold. Observe two-color wires closely.
2. Certain applications only.
3. Additional wire length has been added for optional engine compartment mounting.

Table 6.2 Sensor and Relay Installation

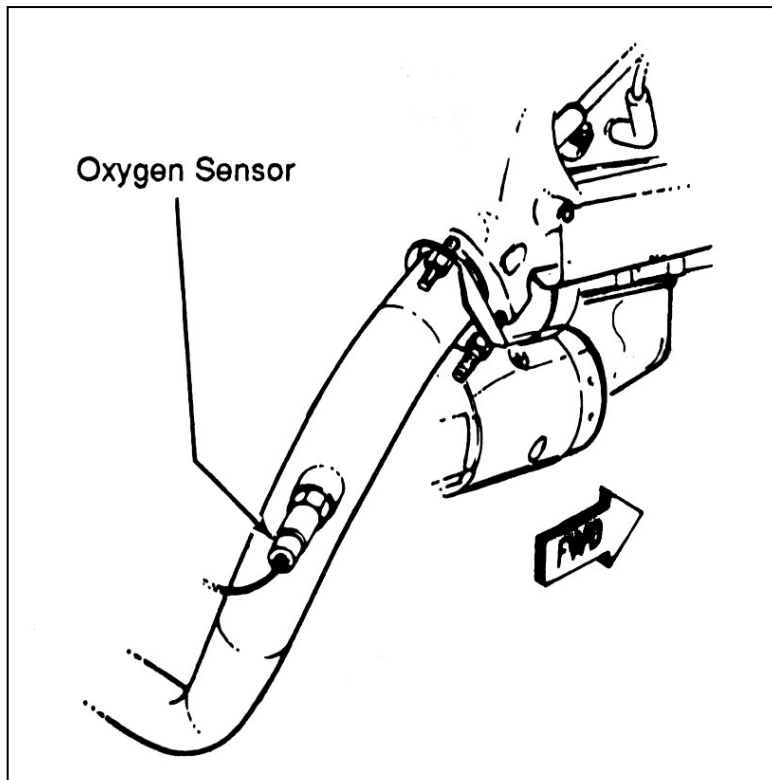


Figure 6.8 Oxygen Sensor

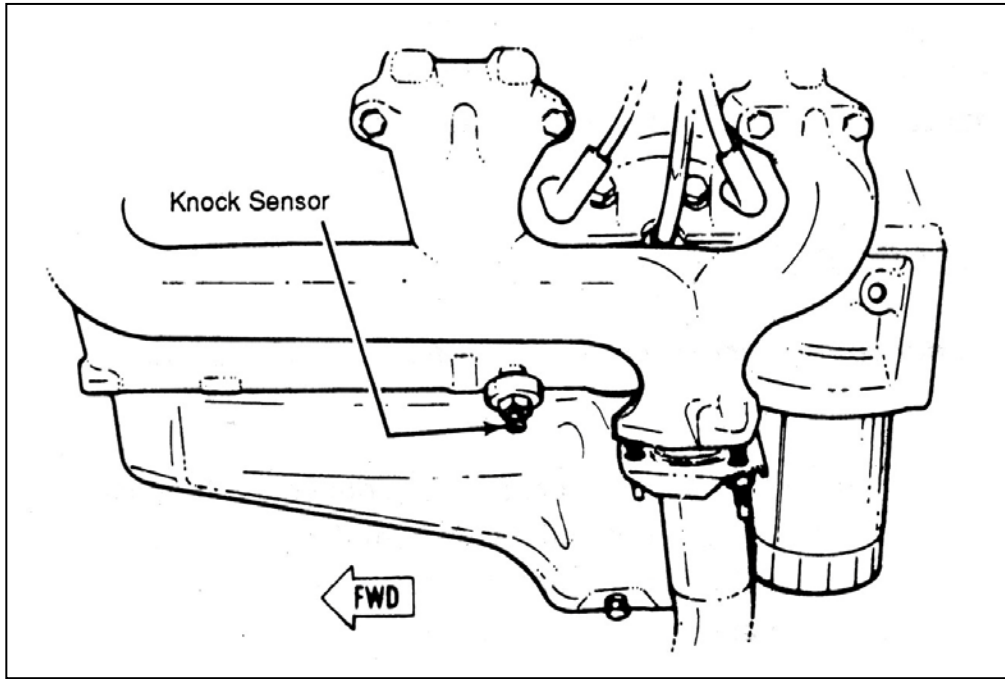


Figure 6.9 Knock Sensor

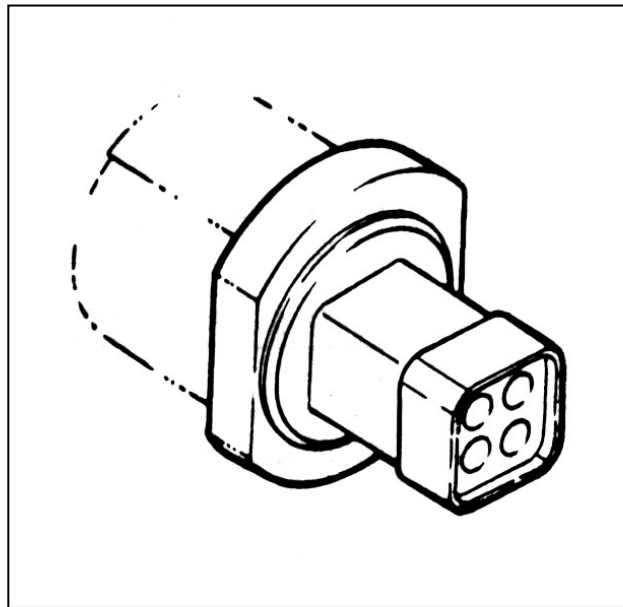


Figure 6.10 TCC Solenoid

7.0 EARLY VERSION GM TUNED PORT INJECTION SYSTEM WIRE HARNESS INSTALLATION INSTRUCTIONS

7.1 CONTENTS OF THE 60102 AND 60202 WIRE HARNESS KIT

- Main wire harness
- Distributor and Oil Pressure
- Fuel injection harness instructions P/N 90503 (this booklet)

The following optional parts are not included in the kit but are available from Painless Performance.

- Emission Control Device Harnesses. (Part #60312 or 60313)

7.2 ENGINE GROUP INSTALLATION

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

- 7.2.1** Before you connect any wires, separate the tail section from the engine group and place it out of the way.
- 7.2.2** Locate the two Blk/Wht wires in the harness that end in a single, large ring terminal and ground them to the engine.
- 7.2.3** Using **Figure 7.5, Table 6.1** and the specific illustrations indicated in **Table 6.1**, connect the wiring as directed.
- 7.2.4** Green wire tagged A/C POWER attaches to the A/C compressor power wire at the compressor if the vehicle is so equipped. This will increase the engine idle RPM when the A/C is turned on.

7.3 DASH SECTION INSTALLATION

The dash section installation is addressed in the General Installation Instructions, section 5.0, **Paragraph 6.2.1** and follow the instructions there.

7.4 SENSOR AND RELAY INSTALLATION

The following listing is for wires to be cut to length. Connect your wiring accordingly. Route and terminate the following wires in the under dash area;

- 7.4.1** Purple wire tagged VATS attaches to the VATS control module if so equipped.
- 7.4.2** Purple wire tagged BRAKE SWITCH attaches to the brake switch shown in **FIGURE 6.4**
- 7.4.3** Green/White wire tagged FAN RELAY GROUND is the ground for the fan relay if the computer is to be the control for the electric fan.
- 7.4.4** Pink/Black wire attaches to the ignition source described in **6.1.3**
- 7.4.5** Orange/Black and Black/ White wires attach according to your application as discussed in **Section 4.1**

***NOTE:** Any wire that you are not using should be capped & stowed.*

7.5 TAIL SECTION INSTALLATION

The tail section wires are connected as described below.

- 7.5.1** Green – Tan/Blk – Purple wires in the white connector plug into the transmission, if so equipped.
- 7.5.2** Tan/White wire tagged FUEL PUMP attaches to the fuel pump. This is the power wire for the pump.
- 7.5.3** Brown wire tagged VEHICLE SPEED SENSOR attaches to the vehicle speed sensor as described in **SECTION 4.1.4**

Wire Colors	# of Positions In Connector	Labeled	Connect to:
Tan/Blk,Blk/Red,Wht,Pur/Wht	4	IGN	Distributor (Figure 7.1)
Pur	1	OXY	Oxygen Sensor (Figure 6.8)
Blu, Pnk/Blk	4 conn./2 pos.each	INJ	Drivers Side Fuel Injectors (Figure 7.2) ¹
Grn, Pnk/Blk	4 conn./2 pos.each	INJ	Passenger's Side Fuel Injectors (Figure 7.1) ¹
Orn, Tan	-----	OIL	Oil Pressure Switch (Figure 7.2)
Dk.Blu (late) or Wht (early)	1	KNC	Knock Sensor (Figure 6.9) ²
Tan, Blk	2	MAT	Manifold Air Temp Sensor (Figure 7.1)
Blk, Dk.Blu, Gry	3	TPS	Throttle Position Sensor (Figure 7.3)
Lt.Blu/Wht, Lt.Blu/Blk Lt.Grn/Wht, Lt.Grn/Blk	4	IAC	Idle Air Control Motor (Figure 7.3)
Ylw, Blk	2	CTS	Coolant Temp Sensor (Figure 7.3)
Pur, Tan (if applicable)	2	CSW	Cold Start Switch (Figure 7.3) ^{1,3}
Pnk/Blk, Gry	2	EGR	Exh.Gas Recirculation Valve Solenoid (Figure 7.1)
Gry,Grn,Blk	3	MAP	Manifold Absolute Pressure Sensor
Red	----	-----	Starter Solenoid (Lrg. Term.)
Pur	----	-----	Starter Solenoid (Sm.Term.) ³
Pur, Tan (If applicable)	2	CIJ	Cold Start Injector (Figure 7.2) ^{1,3,4}
Dk.Gr, Red, Dk.Blu, Blk/Wht, Blk	5	MAF	Mass Airflow Sensor (Figure 7.4)
Dk.Gr	-----	-----	A/C Power (To Compressor) ⁵
Gry	-----	VATS	To Steering Column VATS Module (late TPI)
Pur	-----	VATS	To Steering Column VATS Module (early TPI)

Notes:

1. On tuned port injection engines, the injectors, cold start switch, and cold start injector all use a connector that simply pushes on. Do not remove the silver attaching clip or the connector may come loose.
2. If you have headers, you may have to relocate the knock sensor for proper clearance.
3. These wires are on EARLY version tuned port systems ONLY.
4. Do NOT confuse this with the cold start switch.
5. The "A/C POWER" wire on both early and late version tuned port systems should be spliced into the A/C compressor power wire near the compressor. If you do not have A/C then tape and store this wire. This wire senses power to the compressor and automatically increases the idle speed of the engine when the A/C is turned on.

Table 7.1 GM Tuned Port Injection Engine Group Connections

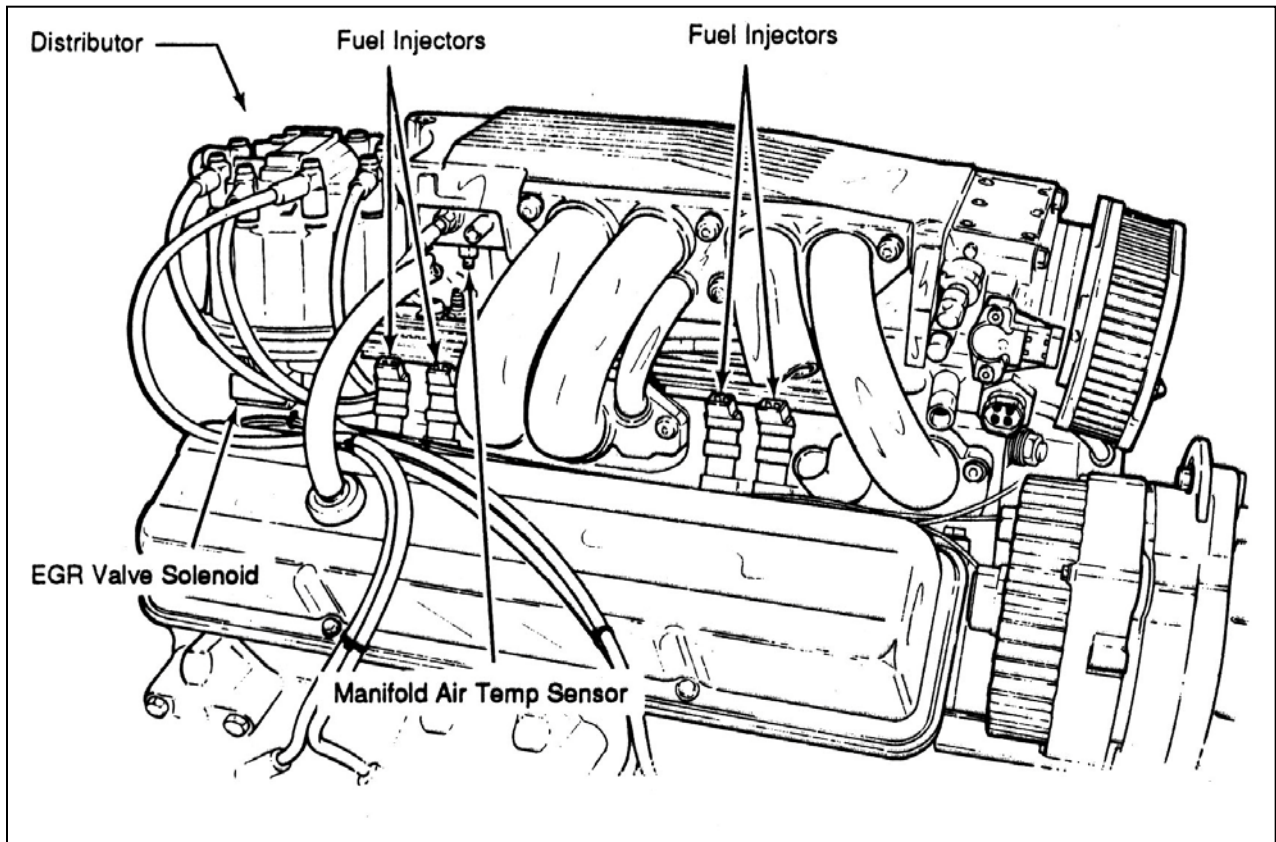


Figure 7.1 Tuned Port Injection System, Right Side

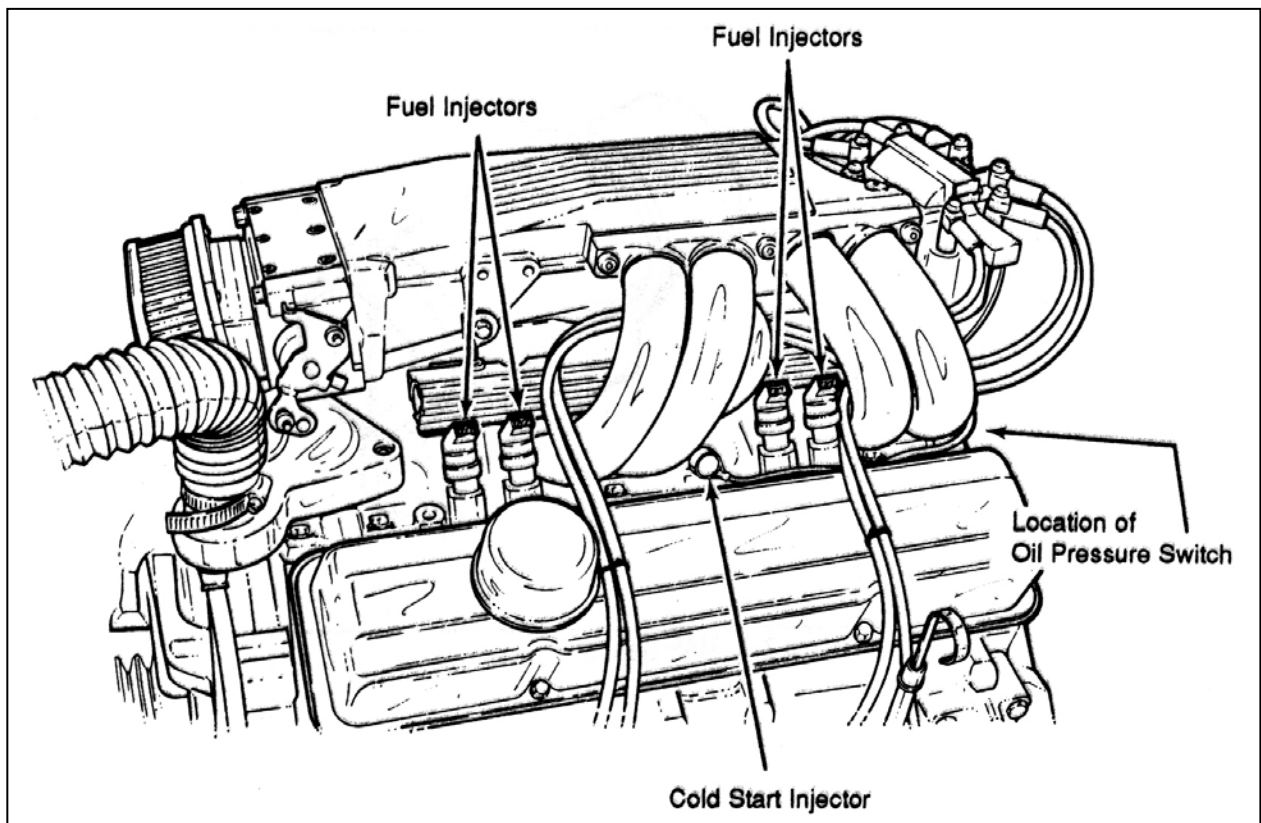


Figure 7.2 Tuned Port Injection System, Left Side

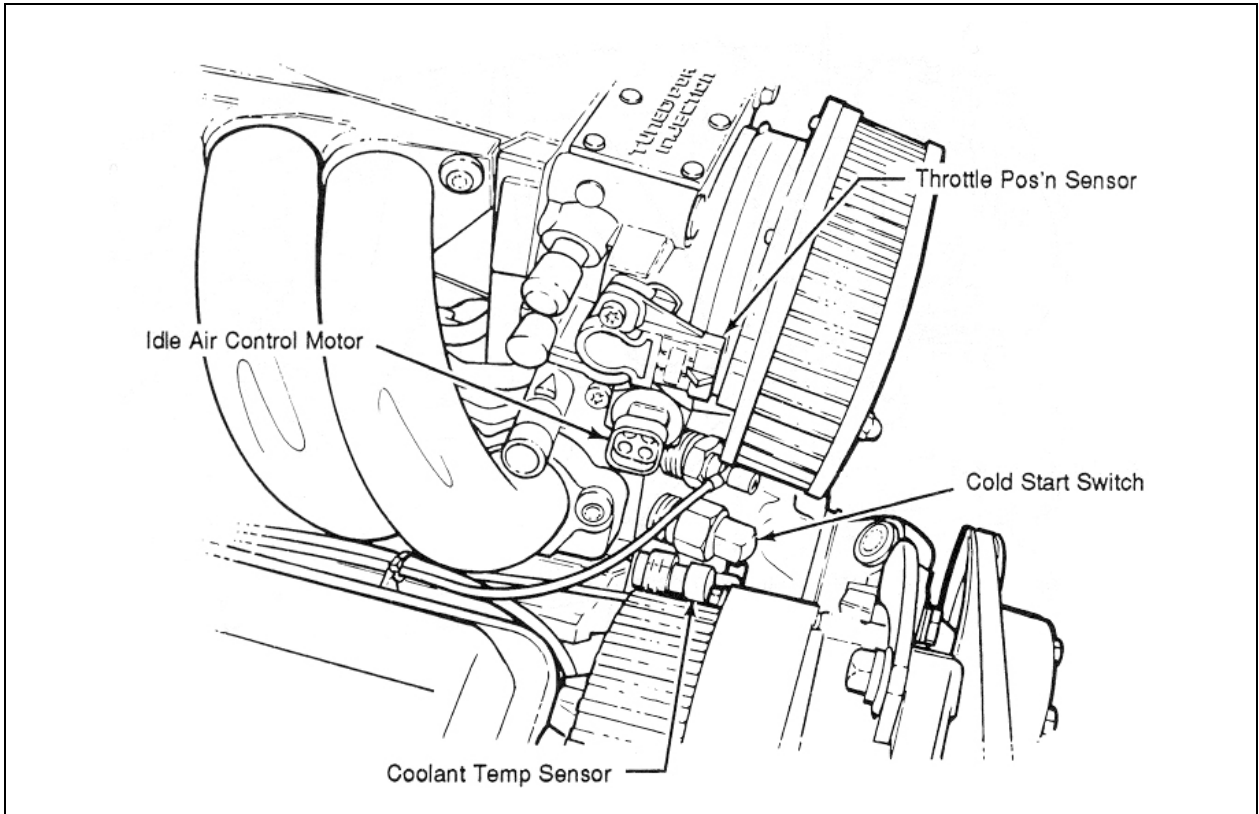


Figure 7.3 Engine Detail, Right Side

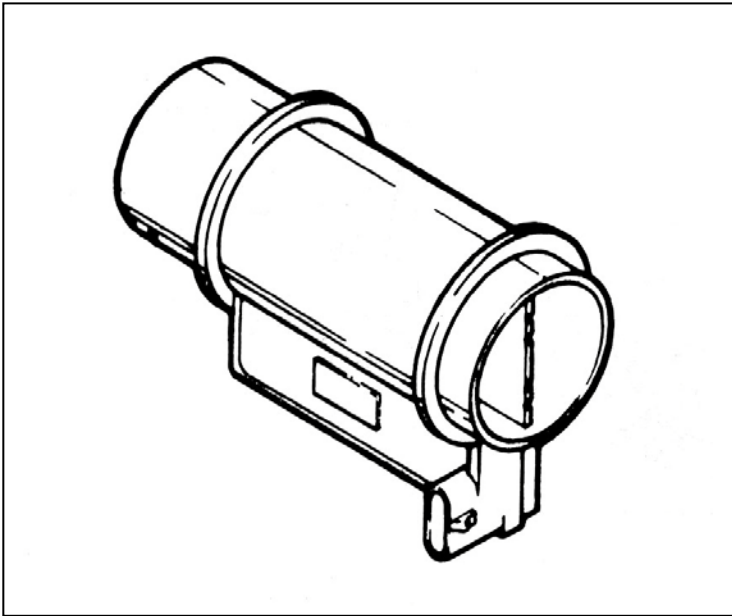


Figure 7.4 MAF Sensor

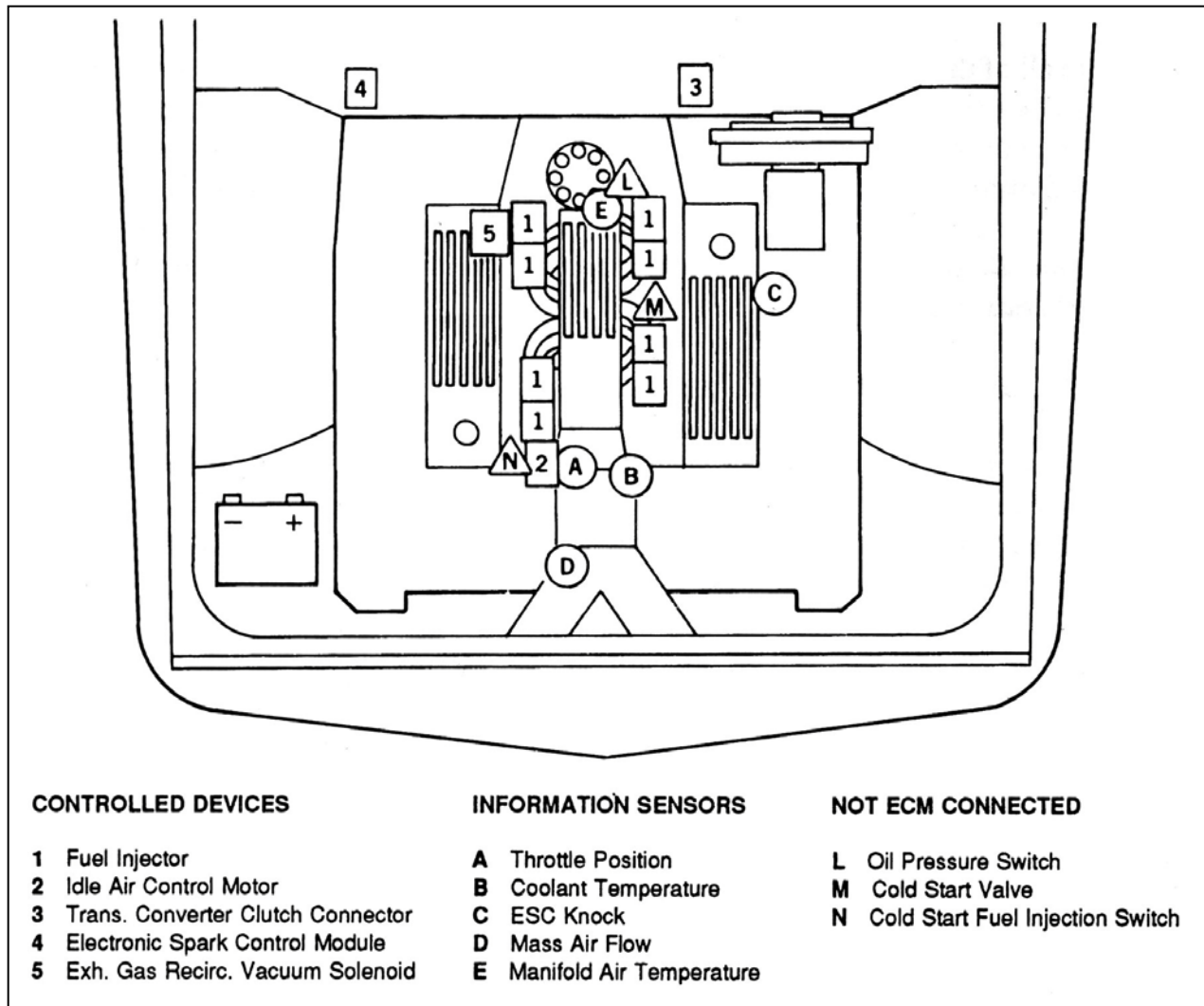


Figure 7.5 Engine Compartment Overview

8.0 LATE VERSION GM TUNED PORT INJECTION SYSTEMS INSTALLATION INSTRUCTIONS

8.1 CONTENTS OF THE 60103 AND 60203 WIRE HARNESS KIT

- Main wire harness with connectors on the ends of many of the wires.
- Distributor and Oil Pressure Adapters.
- Fuel injection harness instructions P/N 90503 (this booklet).

The following optional parts are not included in the kit but are available from Painless Performance.

- Emission Control Device Harnesses. (Part #60314 and 60315)

Notes: All factory computer proms (chips), for the late TPI Systems and some early TPI computers have the vehicle anti-theft system programmed into them. An after-market chip must be used with the VATS removed or the original steering column and VATS module must be used or the engine will not start.

8.2 ENGINE GROUP INSTALLATION

The engine group is connected as described in **Section 7.2** of these instructions except that the engine will not have a mass airflow (MAF) sensor. This system utilized a Manifold Absolute Pressure (MAP) sensor. When mounting this sensor, it is important to remember that A) the vacuum port on the sensor must point straight down, and B) if not in the stock location, you will have to use factory style hard plastic line to make the connection. Do not forget to ground the two Blk/Wht wires to the engine.

8.3 DASH GROUP INSTALLATION

The dash section is connected as described in **Paragraph 6.2.1** of these instructions.

8.4 SENSOR AND RELAY INSTALLATION

The sensor and relays are connected according to **SECTION 7.4** of these instructions, using **Table 6.1**

8.5 TAIL SECTION INSTALLATION

The tail section wires consist of:

- A. Purple and Yellow wires tagged VEHICLE SPEED SENSOR, after cutting to proper length, attach to the two wires coming out of the Part Number 60116 speed sensor. It makes no difference how the wires are attached. The connector may have to be cut off the 60116 speed sensor to connect to it.
- B. Gray wire tagged FUEL PUMP is the power wire for the pump. Route and cut to length.
- C. Lt.blu, tan/blk and purple wires, in the white connector, plugs into 700R4 if so equipped.

9.0 PRE-ADJUSTMENTS BEFORE STARTING ENGINE

9.1 Throttle Position Sensor Adjustment

- 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 digital voltmeter's probes into the blue and black wires in the back of the sensors connector, which is plugged into the sensor.
- D. Loosen the sensor mounting screws and adjust the sensor until the meter reads .5 volts (1/2 of one volt).
- E. Tighten the mounting screws and recheck the meter reading.
- F. Some after market chips require a different setting, check their instructions carefully

9.2 Base Engine Idle Adjustment

- A. Turn on ignition but do not start engine.
- B. Jumper A & B of the ALDL as if you were checking codes.
- C. Wait 30 seconds and then remove the plug from the IAC motor.
- D. Remove jumper from ALDL.
- E. Start engine and adjust idle speed with adjusting screw at throttle lever (there may be a cap covering the adjusting screw that will need to be removed and discarded).
- F. Shut off engine and disconnect battery for one minute.
- G. Plug the IAC connector back in and then reconnect the battery.
- H. Start engine and check for proper idle speed.

10.0 TROUBLE SHOOTING INSTRUCTIONS

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

10.1 THE "CHECK ENGINE" LIGHT

Normally, the "check engine" light should come on when the ignition is initially turned on, 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.

10.1.1 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" digit) is flashed, followed by a longer pause. For example, three (3) quick flashes followed by a brief pause followed by two (2) flashes indicates code 32.
- B.** The code will repeat itself three (3) 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 3 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.

10.2 RETRIEVING TROUBLE CODES FROM THE COMPUTER

10.2.1 In order to retrieve the trouble codes stored in the computer, locate the Assembly Line Diagnostic Link (ALDL) connector (installed and connected in **Paragraph 6.1.1**). Turn the ignition on, BUT DO NOT START THE CAR. Connect a jumper wire from ALDL terminal "A" to terminal "B" (see **Figure 6.3**) and observe the "check engine" light.

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

10.2.3 Take the codes one at a time and match them to the codes in **Table 9.1**. This will tell you in which circuit the computer has detected a problem.

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

10.2.4 Before taking more extensive corrective actions for any trouble code, 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 ground wires are clean and secure.

10.2.5 If you are getting a code from your computer and need to clear the code, other than code 12, after you have replaced a part, readjusted a part, etc. You can do this by making sure the ignition is off and then disconnecting the negative battery cable for a minimum of two minutes. After the two minutes are up then you simply reconnect the negative battery cable and recheck the system for codes.

CODE #	CIRCUIT AFFECTED	CODE #	CIRCUIT AFFECTED
13	Oxygen Sensor	36 ¹	Mass Airflow Burn Off Circuit
14	Coolant Temp (high)	41 ²	Faulty or Incorrect Mem-Cal Chip
15	Coolant Temp (low)	42 ²	Electronic Spark Timing Circuit
21	Throttle Position Sensor	43	Electronic Spark Control Circuit
23	Manifold Air Temp (low)	44	Oxygen Sensor (lean reading) ⁵
24	Vehicle Speed Sensor ³	45	Oxygen Sensor (rich reading) ⁶
25	Manifold Air Temp (high)	46 ²	Vehicle Anti-Theft System
32	Exh.Gas Recirculation Valve	51,52,55 ²	Faulty Mem-Cal, PROM, or Cal-Pak Chip
33 ¹	Mass Airflow or Manifold Absolute Pres. Sensor (high)	53	Charging System over-voltage
34 ¹	Mass Airflow or Manifold Absolute Pres. Sensor (low)	54	Insufficient Fuel Pump Voltage ⁷
35	Idle Air Control Circuit		

Notes:

- 1.** Your engine will use either a mass airflow sensor and burn off circuit OR a manifold absolute pressure sensor.
- 2.** A PROM, Mem-Cal or Cal-Pak chip that has not been fully seated or that has a bent contact may cause one or all of these codes to set.
- 3.** If the Park/Neutral Indicator switch isn't wired correctly this code can set.
- 4.** Early version TPI and TBI systems only.
- 5.** Can be caused by a clogged fuel filter or a vacuum leak.
- 6.** Can be caused by a clogged air filter.
- 7.** Can be caused by a bad fuel pump relay.

Table 9.1 Diagnostic Trouble Codes

10.3 WHEN TO CALL PERFECT PERFORMANCE PRODUCTS' TECH LINE

10.3.1 These harness kits have been built with the highest regard to strict quality control. Before calling us please double-check all connections and perform normal basic trouble shooting (fuel pressure, timing, ignition system, etc.).

11.0 ADD ON EARLY TPI EMISSIONS KIT

(For Part #60102 use Painless #60312 and for Part #60202 use Painless #60313)

The emissions wires in this kit include: the wiring for the charcoal canister, the air port solenoid the air pump diverter valve, and the EGR diagnostic temperature sensor. (See Diagram 2, page 29).

STEP 1 - INSTALLATION OF CONNECTORS IN THE ENGINE COMPARTMENT

Install the following connectors into these locations:

The red connector with the Dk.Grn/Ylw and Blk/Pnk wires, plugs into the charcoal canister mounted in the engine compartment.

The black connector with the Blk/Red and Blk/Pnk wires, plugs into the air port solenoid located on the back of the air pump.

The gray connector with the Brn and Blk/Pnk wires, plugs into the air pump diverter valve located behind the air pump.

The black connector with the single Dk.Grn wire plugs into the EGR valve diagnostic temperature connector located under the center of the intake plenum.

STEP 2 - ROUTING THE WIRES

Route all of the wires from the front three connectors up to the coolant temperature sending unit located at the front of the engine next to the thermostat housing. Using tie wraps secure the wiring to the coolant temp sensor (black and yellow) wires all the way back to the computer located inside the vehicle. Be sure to leave enough slack for any possible engine movement.

Caution: Be careful routing the wires through the firewall to avoid damaging the terminals on the ends of the wires.

STEP 3 - ATTACHING THE B+ POWER WIRES

You will find that the three Blk/Pnk wires, end near the back of the engine block. These wires should be spliced into the Pnk/Blk wire coming from the EGR solenoid connector. These wires can also be extended and connected to a 12 volt ignition only (switched) power source if you wish to do so.

STEP 4 - UNPLUGGING THE COMPUTER

Caution: Removing the computer connectors from the computer while the ignition is on will damage the computer!

First making sure that the ignition is off, unplug the two computer connectors by pushing down on the blue retaining tab and then pulling straight out and away from the computer. **Be careful not to damage the computer pins!** Remove the blue secondary locks from the black computer connectors by releasing the retaining clips and pulling them out from the back (wire) side of the connectors.

STEP 5 - CONNECTING THE CHARCOAL CANISTER WIRE AT THE COMPUTER

Locate the 24-pin (the smaller of the two) computer connector. Using the attached wiring diagram for reference, look on the wire side of the connector housing for the corner marked "A-1". Once you have located this, count down the openings on the same side until you reach "A-3". You will insert the terminal on the Dk.Grn/Ylw wire (charcoal canister) into this opening, pushing in until the locking tang engages.

Note: The terminal will only fit one way into the connector; do not try to force the terminal.

STEP 6 - CONNECTING THE AIR PORT SOLENOID WIRE AT THE COMPUTER

On the same connector, locate "A-2". This is the opening that you plug the terminal on the Brn wire (port solenoid) into, using the same procedure as in step 5.

Note: this wire has a second Brn wire spliced into it that should be set aside until Step 10.

STEP 7 - CONNECTING THE AIR DIVERTER WIRE AT THE COMPUTER

Locate the 36-pin (the larger of the two) computer connector. In the same manner as you did in Step 5 and 6, locate the "C-1" side. When you have done this, then count down the same side one opening to "C-2". This is the opening you will insert the terminal on the Blk/Red wire into. (air pump diverter valve)

STEP 8 - CONNECTING THE EGR TEMPERATURE WIRE AT THE COMPUTER

On the same side of the same connector as you were using in Step 7, find "C-15". This is the opening for the terminal on the Dk.Grn wire (EGR diagnostic temp).

STEP 9 - REPLACING THE COMPUTER CONNECTORS AT THE COMPUTER

Replace the secondary locks on both connectors. Be careful to line up the "fingers" on the locks with the connector openings. Once you have the secondary locks in place then you can reinstall the computer connectors into the computer.

Caution: use care when reinstalling the connectors, to avoid damaging the computer pins.

STEP 10 - ATTACHING THE AIR PUMP DIAGNOSTIC WIRE AT THE ALDL

The brown wire set aside in step 6 goes to the ALDL connector (diagnostic plug).

Route this brown wire along the existing ALDL wiring until you come to the connector itself. The wire is inserted into the opening labeled "C" on the connector. (See Diagram 2, page 29)

Notes: Double check all routing making sure that there is enough slack to allow for any engine or other movement. Reinstall any grommets or other parts taken off.

Start and drive the vehicle for at least thirty minutes, then check for any trouble codes stored in the computer.

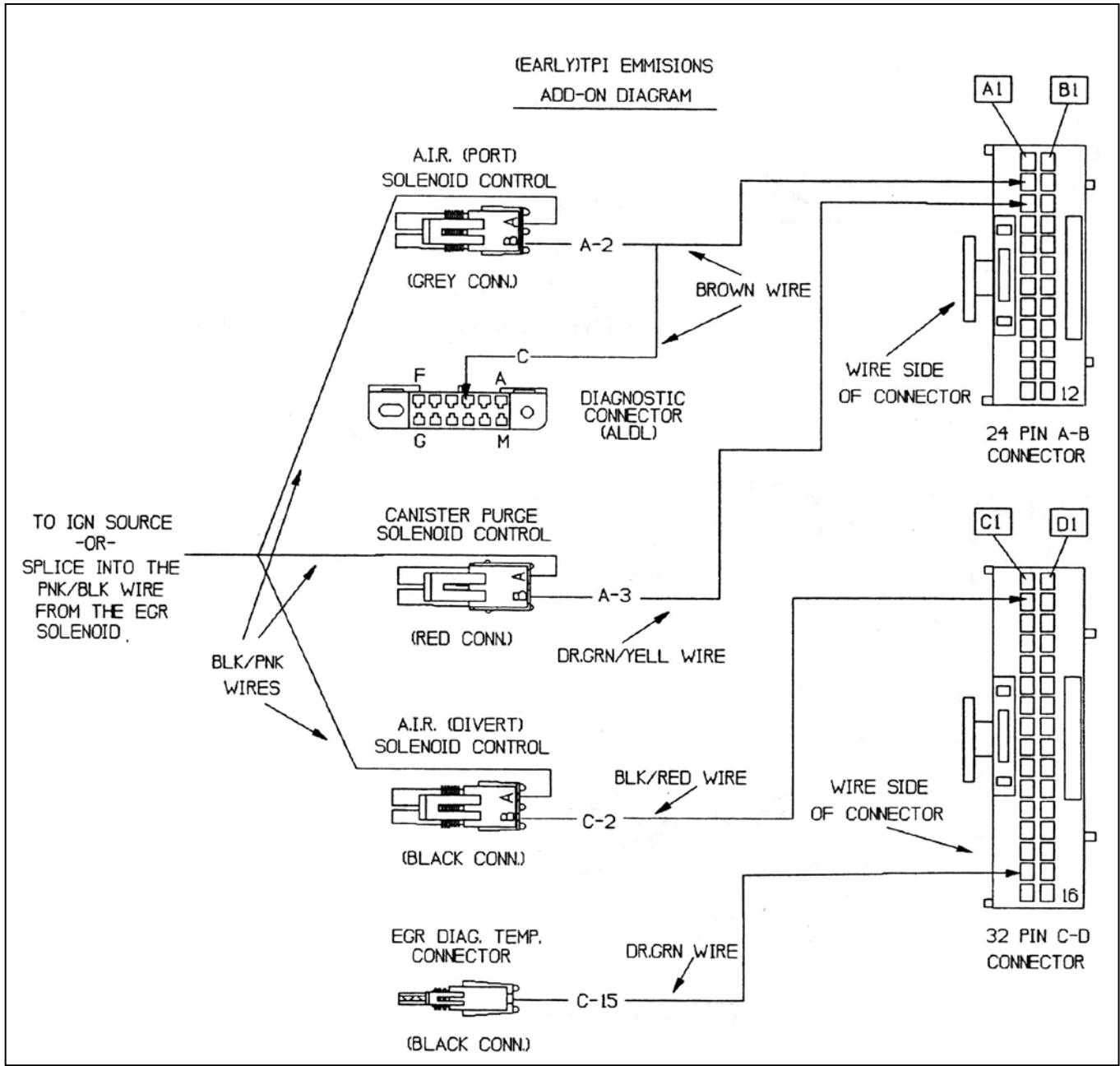


Diagram 2 Early TPI Emissions

12.0 ADD ON LATE TPI EMISSIONS KIT

(For Part #60103 use Painless #60314 and for Part #60203 use Painless #60315)

The emissions wires in this kit include: the wiring for the charcoal canister, the air port solenoid and the air pump diverter valve. (See Diagram 3, page 32).

STEP 1 - INSTALLATION OF CONNECTORS IN THE ENGINE COMPARTMENT

Install the following connectors into these locations:

The red connector with the Dk.Grn/Ylw and Blk/Pnk wires, plugs into the charcoal canister mounted in the engine compartment.

The black connector with the Blk/Red and Blk/Pnk wires, plugs into the air port solenoid located on the back of the air pump.

The gray connector with the Brn and Blk/Pnk wires, plugs into the air pump diverter valve located behind the air pump.

STEP 2 - ROUTING THE WIRES

Route all of the wires from the front three connectors up to the coolant temperature sending unit located at the front of the engine next to the thermostat housing. Using tie wraps secure the wiring to the coolant temp sensor (black and yellow) wires all the way back to the computer located inside the vehicle. Be sure to leave enough slack for any possible engine movement.

Caution: Be careful routing the wires through the firewall to avoid damaging the terminals on the ends of the wires.

STEP 3 - ATTACHING THE B+ POWER WIRES

You will find that the three Blk/Pnk wires, end near the back of the engine block. These wires should be spliced into the Pnk/Blk wire coming from the EGR solenoid connector. These wires can also be extended and connected to a 12 volt ignition only (switched) power source if you wish to do so.

STEP 4 - UNPLUGGING THE COMPUTER

Caution: Removing the computer connectors from the computer while the ignition is on will damage the computer!

First making sure that the ignition is off, unplug the three computer connectors by pushing down on the blue retaining tab and then pulling straight out and away from the computer. Be careful not to damage the computer pins! Remove the blue secondary locks from the yellow computer connector by releasing the retaining clips and pulling them out from the back (wire) side of the connector.

STEP 5 - CONNECTING THE CHARCOAL CANISTER WIRE AT THE COMPUTER

Using the attached wiring diagram for reference, look on the wire side of the connector housing for the corner marked "F-1". Once you have located this, count down the openings on the same side until you reach "F-7". You will insert the terminal on the Dk.Grn/Ylw wire (charcoal canister) into this opening, pushing in until the locking tang engages.

Note: The terminal will only fit one way into the connector; do not try to force the terminal.

STEP 6 - CONNECTING THE AIR DIVERTER WIRE AT THE COMPUTER

On the same connector, in the same manner as you did in Step 5, locate the "F-4" side. This is the opening you will insert the terminal on the Blk/Red wire into. (air pump diverter valve)

STEP 7 - CONNECTING THE AIR PORT SOLENOID WIRE AT THE COMPUTER

On the same connector, locate "F-2". This is the opening that you plug the terminal on the Brn wire (port solenoid) into, using the same procedure as in step 5 and 6.

STEP 8 - REPLACING THE COMPUTER CONNECTORS AT THE COMPUTER

Replace the secondary locks on the connector. Be careful to line up the "fingers" on the locks with the connector openings. Once you have the secondary locks in place then you can reinstall the computer connectors into the computer.

See Drawing at the back of this manual.

Caution: use care when reinstalling the connectors, to avoid damaging the computer pins.

Notes: Double-check all routing making sure that there is enough slack to allow for any engine or other movement. Reinstall any grommets or other parts taken off.

Start and drive the vehicle for at least thirty minutes, then check for any trouble codes stored in the computer.

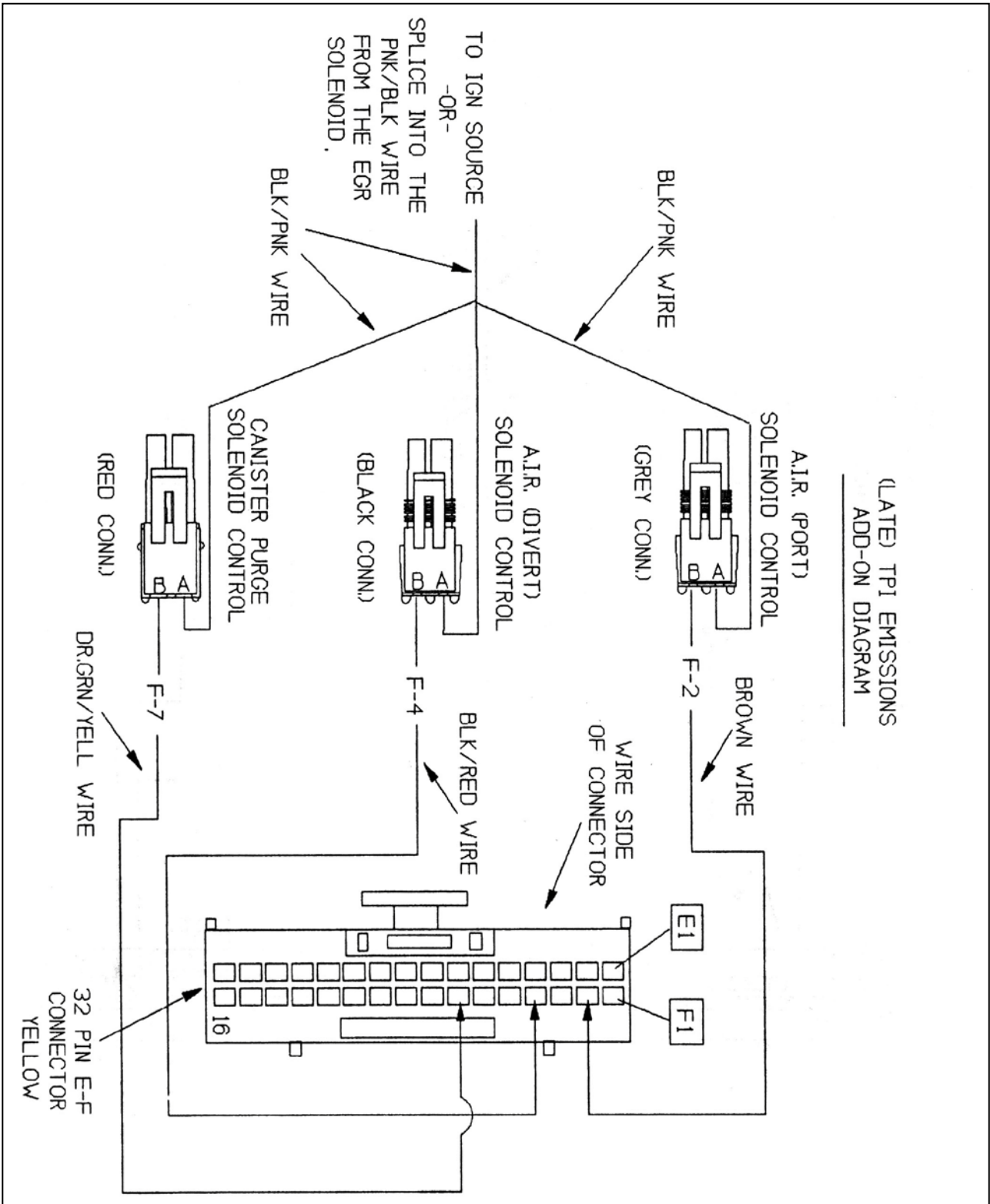


Diagram 3 Late TPI Emissions

Brake Switch Connection

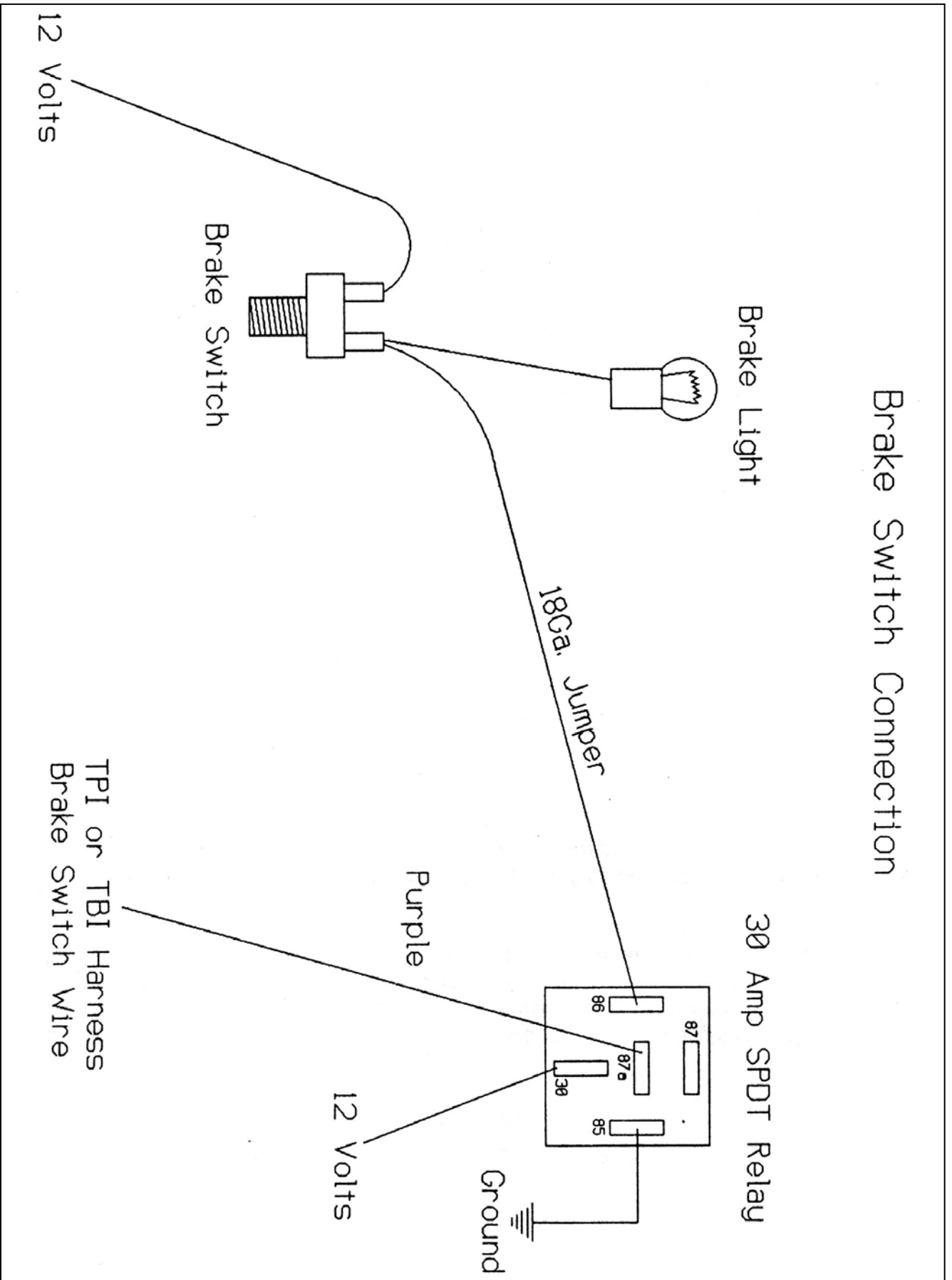


Diagram 4 Brake Switch Relay Connection

Painless Performance Limited Warranty and Return Policy

Chassis harnesses, fuel injection harnesses and Striker ColdShot units 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.