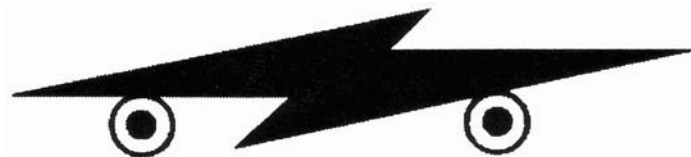




Jeep® Fuel Injection **by *Electromotive, Inc.***



Installation and User's Manual

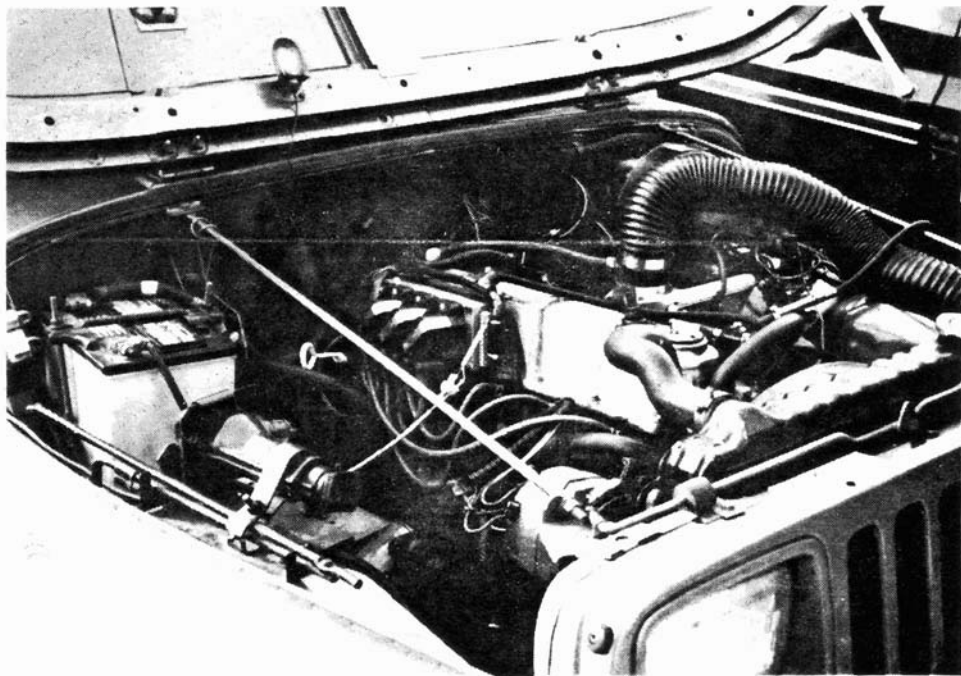
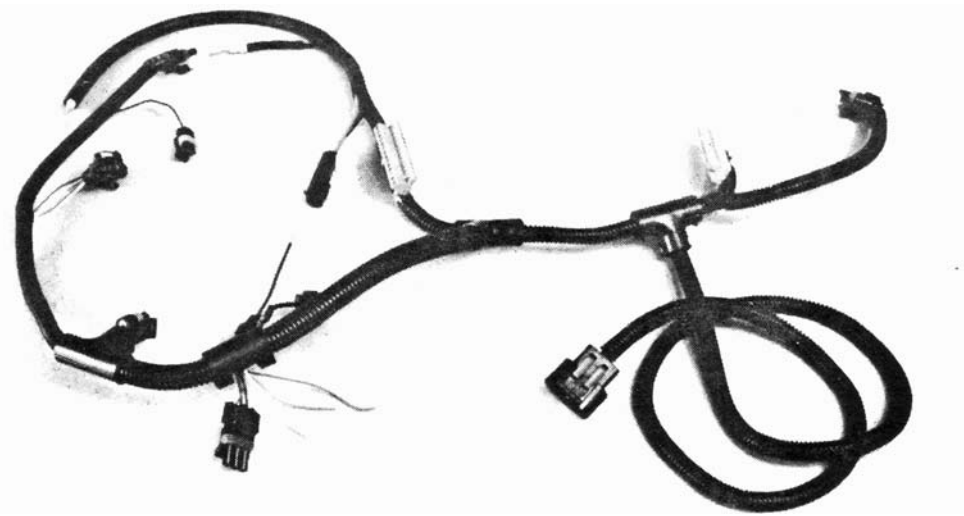
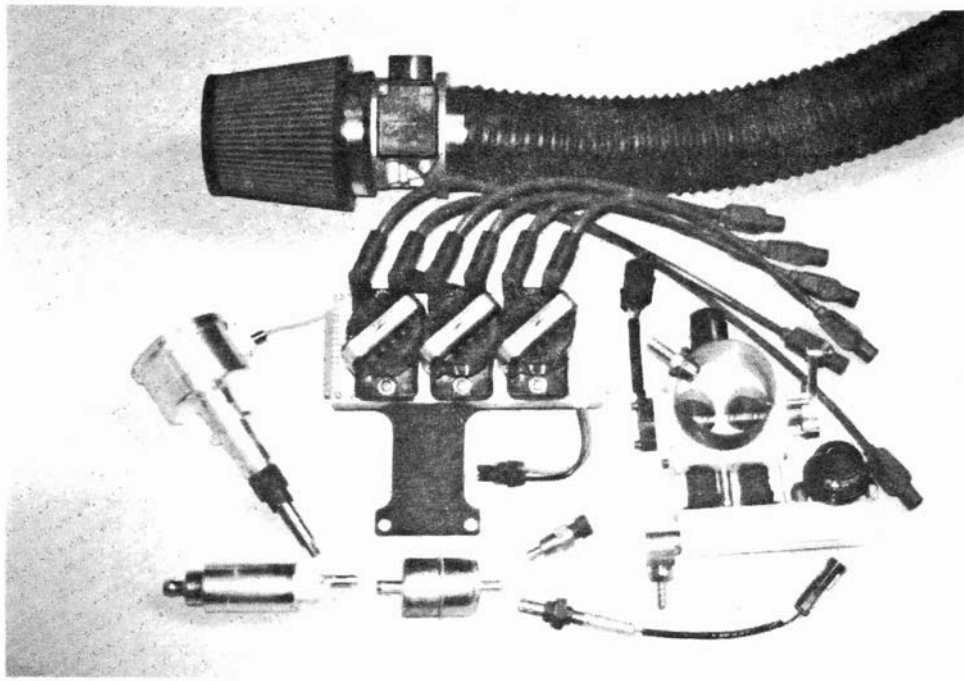
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**This kit is legal to sell, distribute and install on
vehicles in California under CARB E.O. # D-346-1.**

Electromotive Direct Ignition is protected under U.S. Patent Number RE 34,183

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Electromotive Instruction Manual

JEEP 4.2L FUEL INJECTION CONVERSION KIT

Electromotive combines its patented Direct Ignition System (DIS) and Fuel Injection into a Total Engine Control (TEC) package for 4.2L (258 cid) Jeeps. The JFI kit utilizes a custom designed throttle body with Mass Air Flow (MAF) and heated oxygen sensor to precisely maintain the correct air to fuel ratio for minimum emissions, best power and good fuel economy. The JFI kit provides great starting, both hot and cold. Off-road maneuverability is also greatly improved by eliminating troublesome float bowls and making low speed stalls a thing of the past.

In addition to greatly improving overall driveability, the Electromotive JFI kit simplifies the under hood vacuum hoses by actually removing some emissions control devices. The JFI kit replaces these systems with an advanced engine control system capable of better pollution control. By eliminating these failure prone devices, the JFI will increase durability. With this kit, your jeep will meet all EPA guidelines and qualify for E.O. (executive order) D-346 by California Air Resources Board (CARB) making it legal to sell distribute and install on vehicles in California. You can now have it all: improved driveability, improved reliability and decreased emissions!

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Hardware Installation

Unpacking:

Always carefully inspect all items and determine if any damage occurred in shipping. If damage is evident contact the shipper for instructions as to the recovery of such damages.

Kit Contents Check List: Review the contents of the kit by checking off the items listed below.

- ☐ TEC-II Electronic Control Unit (ECU) with coils
- ☐ TEC-II mounting bracket
- ☐ wiring harness
- ☐ distributor trigger assembly with magnetic sensor
- ☐ throttle body (TBI) includes fuel injectors, IAC motor, TPS, fuel rail & pressure regulator
- ☐ Mass Air Flow (MAF) sensor
- ☐ 4' of 3" diameter air inlet flex tubing
- ☐ air filter with gear clamp
- ☐ spark plug wire set (6 wires), qty 1 set
- ☐ fuel filter ($\frac{3}{8}$ " x $\frac{3}{8}$ ")
- ☐ electric fuel pump
- ☐ high pressure fuel hose ($\frac{5}{16}$ "), qty 5 feet

The following items are packed in the parts bag:

- ☐ coolant (CLT) sensor
- ☐ heated Exhaust Gas Oxygen (EGO or O_2) sensor
- ☐ TEC mounting bolts ($\frac{1}{4}$ "-20 x $1\frac{1}{4}$ "), qty 4
- ☐ TEC mounting bolt lock nuts ($\frac{1}{4}$ "-20), qty 4
- ☐ MAF mounting bolts (6mm x 1.0 x 20mm), qty 3
- ☐ 3" gear clamps, qty 2
- ☐ TBI base gasket, qty 1
- ☐ TBI mounting bolts ($\frac{5}{16}$ "-18 x $1\frac{3}{4}$ "), qty 4
- ☐ vacuum line cap for charcoal canister bowl vent, qty 1
- ☐ vacuum tee ($\frac{3}{8}$ " x $\frac{3}{8}$ " x $\frac{3}{8}$ "), qty 1
- ☐ mounting strap for fuel pump, qty 1
- ☐ foam tape for fuel pump mounting strap ($\frac{5}{8}$ "), qty 1
- ☐ fuel pump hook-up wire, 20 gauge, qty 12 foot
- ☐ fast-on wire terminal for fuel pump ($\frac{1}{4}$ "), qty 1
- ☐ fast-on wire terminal for fuel pump ($\frac{3}{16}$ "), qty 1
- ☐ high pressure fuel hose ($\frac{3}{8}$ "), qty 6 inches
- ☐ fuel hose gear clamps, qty 8
- ☐ PCV breather hose ($\frac{3}{8}$ "), qty 1 foot
- ☐ crimp connectors and heat shrink tubing kit (four connections), qty 1
- ☐ diode for alternator, qty 1

The following items are packed together:

- ☐ CARB E.O. number certification underhood emissions label
- ☐ JFI kit instruction manual (you are reading it now)

Common Items not included (available at any auto parts store):

- ☐ gasket cement, thread sealant
- ☐ wire ties
- ☐ if additional fuel hose is required, use actual fuel line with internal braid rated 250psi minimum
- ☐ block off plate to cover hole from mechanical fuel pump (big block Chevy plate works)

Special Order Items from Electromotive (not always needed):

- ☐ weld-in EGO boss for vehicles without a factory EGO sensor in exhaust pipe. EMI Part #72111
- ☐ Tach Amplifier may be needed for some OEM tachometers to read correctly. EMI Part #15210

Special Tools:

- ☐ electric hand drill with 5/16" and 1/4" drill bits
- ☐ standard automotive inductive timing light
- ☐ tube cutting and flaring tools (if modifications to metal fuel lines are necessary)
- ☐ wire stripper, wire connector crimper, electrical insulating tape

Emission Related Devices:

To meet emissions guidelines with the CARB E.O. exemption number D-346 included with this kit, it is mandatory that all instructions in this installation manual be followed. In particular, four emissions control devices must remain installed, be connected as instructed below and be fully operational:

1. Catalytic converter (if your model year vehicle came equipped from the factory)
2. Exhaust Gas Recirculation (EGR)
3. Positive Crankcase Ventilation (PCV)
4. Charcoal canister including fuel tank vent line and purge signal line

The OEM vacuum diagram included with this kit is based on a 1989 Jeep Wrangler. Earlier model vehicles may vary slightly. During installation, consult the included JFI vacuum diagram and, if available, the schematic for your model year vehicle. Note the simplification of under hood vacuum hoses with the JFI kit.

Failure to follow the guidelines, warnings and instructions included with this kit:

- 1) Can violate state and federal laws.
- 2) Will nullify the CARB emissions exemption granted to this kit.
- 3) May adversely effect emissions, performance and fuel economy.

Step By Step Installation Instructions

The JFI kit is a bolt-on conversion, but If you feel that you may not have the mechanical proficiency to perform the changes, then have an experienced mechanic do the installation. Call us for the location of the nearest Electromotive authorized JFI installation center to your area. Before starting the actual installation, take the time to read these instructions through to the end. During installation, check off each step as it is completed. Common sense and normal caution should always be followed when working on any vehicle, especially when working with high pressure fuel. Keep a standard ABC fire extinguisher available when working with gasoline. When working under your vehicle, always use proper jack stands. Do not rely on a floor jack.

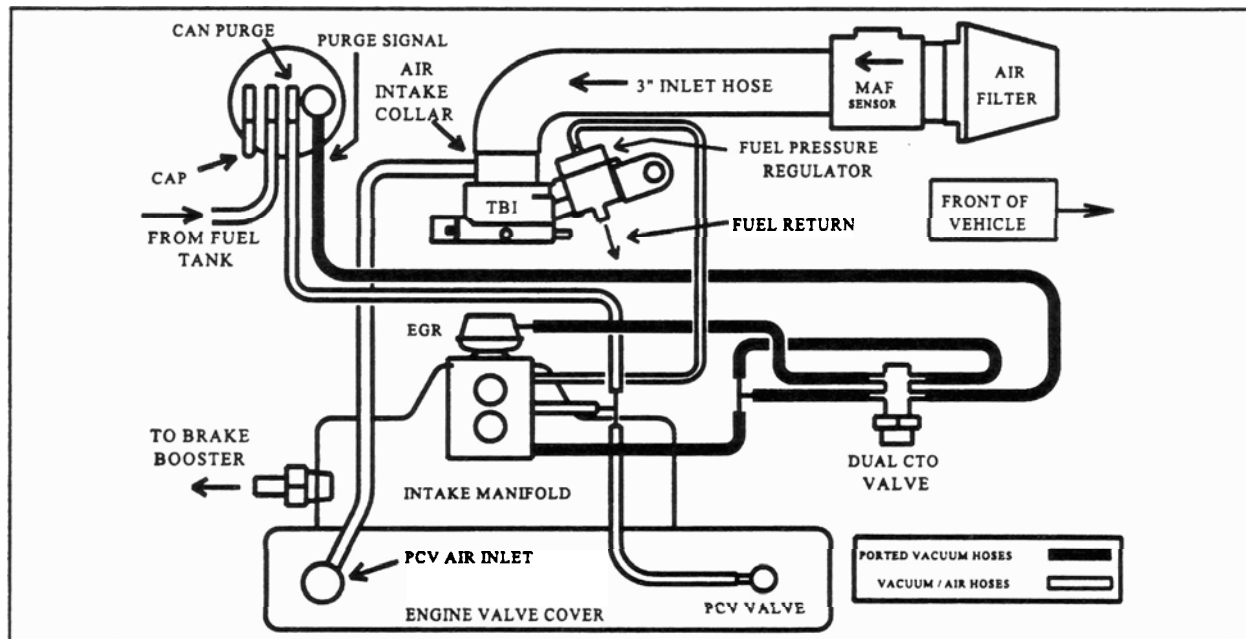
The Jeep has evolved during the years covered by this kit (1972 to 1990). Although this kit is engineered to work on all the model years indicated, in some details, your vehicle may deviate from this manual. All variances encountered at the time this manual was written have been minor. The primary engineering mule was a 1989 Jeep Wrangler. Significantly older vehicles may require you to improvise. If parts are missing from your vehicle that are important to this kit, try buying replacement parts for the 1989 Wrangler. They may be easier to find, may fit the kit better and may even be cheaper than your model year.

NOTES: Some items to be removed may not apply to your specific model year vehicle. When removing the carburetor and ignition distributor take care not to allow foreign material to fall into the openings. Plug with a clean rag or tape over holes until the Electromotive parts are installed. Much of the OEM wiring harness should be looped and tied back or altogether removed. Some instrumentation wires, such as coolant temperature sender, should remain.

☐ Step 1 Disconnect the black ground cable from the battery. Then disconnect the red +12v cable from the battery.

☐ Step 2 Remove the following parts in the order that they appear:

- ☐ - air cleaner assembly and bracket that held air cleaner stud to valve cover; save bolts
- ☐ - three screws holding the washer reservoir (to access to the charcoal vapor canister)
- ☐ - fuel line from pump to carburetor; use caution around gasoline and vapors
- ☐ - fuel return hose from carburetor to metal line
- ☐ - disconnect the OEM ignition module connectors
- ☐ - ignition wires, OEM distributor; save bolts and hold down clamp for reuse
- ☐ - label ignition coil wires as C+ (plus) and C- (minus), remove coil; save bolts for reuse
- ☐ - knock sensor, located forward of the carburetor in the intake manifold
- ☐ - oxygen (O₂) sensor, located in the exhaust below the intake manifold
- ☐ - coolant sensor, located on the side of the intake manifold, forward of the carburetor
- ☐ - install supplied coolant sensor in place of removed factory sensor, use sealant on threads
- ☐ - three vacuum solenoids located above valve cover and all associated vacuum lines
- ☐ - two vacuum switches and lines located on the fire wall and all associated vacuum lines
- ☐ - carburetor bowl vent hose between carb and charcoal canister
- ☐ - install included vacuum cap on carburetor bowl vent hose barb on charcoal canister
- ☐ - PCV valve hose and solenoid - this kit uses the factory PCV part number
- ☐ - decel valve and hoses located on the intake manifold
- ☐ - secondary throttle return spring; save for reuse
- ☐ - carburetor, carb idle step-up solenoid, carburetor spacer, studs and old gasket
- ☐ - air pump and associated brackets (early model Jeeps)
- ☐ - pulse air tube and valves from exhaust- remove and plug
- ☐ - diverter valve (early models) - remove plumbing and plug manifold or cap off
- ☐ - (optional) mechanical fuel pump - if removed install big block Chevy fuel pump block off plate

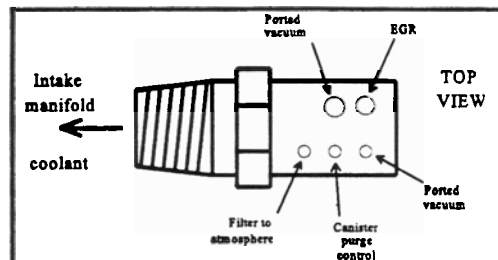


JFI Vacuum Schematic

- Step 3 Install the supplied heated oxygen (EGO / O₂) sensor where the factory non-heated sensor was located in the exhaust manifold. Weld-in EGO sensor mounting bosses are available from Electromotive (part #72111) if your vehicle was not EGO equipped from the factory.

- Step 4 Clean manifold surface and install JFI throttle body using supplied gasket and bolts. The throttle linkage arm should be facing the drivers side fender. The included 3/8" thick gasket has been relieved to clear the throttle position sensor (TPS). Orient the gasket appropriately. Note the intake manifold heater. When your engine is running (has oil pressure) and is below 160°F, the heater should be on. To maintain good driveability and help reduce emissions, this heater system must remain installed and be functional.

- Step 5 Connect ported vacuum hose from the DUAL CTO (four vacuum ports) to the JFI throttle body (TBI). This operates the EGR and charcoal canister purge signal. See included JFI vacuum schematic and side view diagram of TBI for more information. If your vehicle has a five port CTO, see the 5 port diagram for connection details.

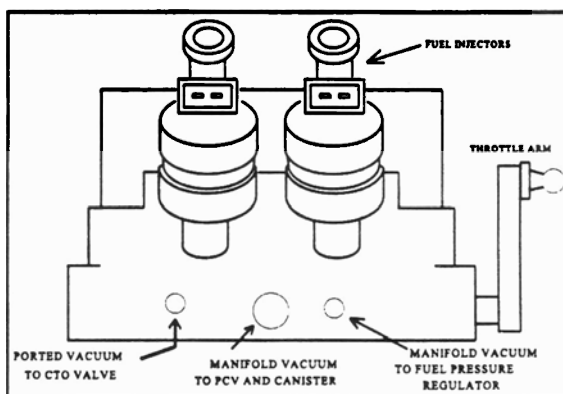


Five port CTO vacuum connections

- Step 6 Connect the 3/8" vacuum lines from the canister purge and PCV to the TBI using the supplied 3/8" TEE.
- Step 7 Verify the 5/32" vacuum line runs from hose barb on the fuel pressure regulator to vacuum port on the throttle body. See side view diagram to identify the correct vacuum port on the TBI.

- Step 8 Attach the OEM throttle linkage to the 1/4" ball stud on the TBI throttle linkage. On some models, the ball may appear to be on the wrong side of the TBI's throttle arm.

Do not remove the ball from the throttle arm but modify the OEM throttle linkage rod. Disconnect the linkage rod from the lower pivot. Remove the upper spring retainer from the rod and drill through the factory linkage with a 1/4" drill. Some model years may require a hardened drill bit. Take care not to oversize the hole. It is a good idea to drill through with a smaller bit and then follow with the 1/4" bit. Reinstall the spring retainer on the other side of the rod and insert the throttle arm ball. The linkage should now be properly orientated. If your vehicle has an automatic transmission, adjust the kickdown linkage appropriately.

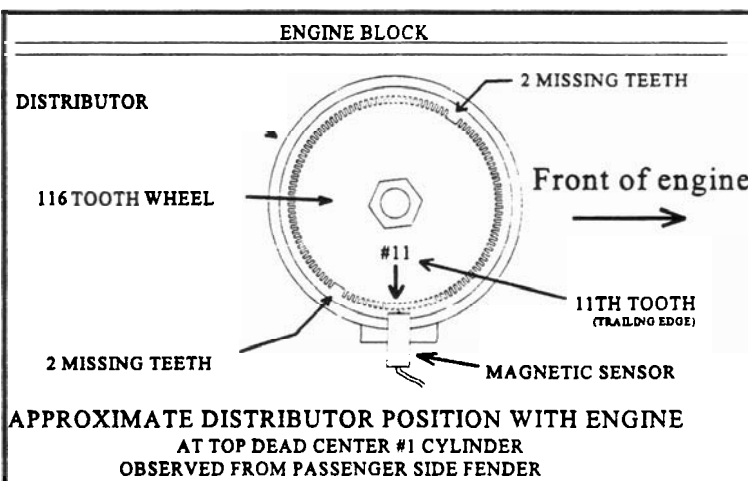


Vacuum ports - TBI side view

- Step 9 Install your factory secondary throttle return spring (removed in step 2) between the factory spring mount and the factory throttle linkage pivot so the spring helps return the throttle position to idle.

- Step 10 Locate Top Dead Center (TDC) of cylinder #1 using OEM instructions and timing marks. The OEM timing mark, located on the balancer, must be aligned to the pointer fixed to the engine. This will be either the compression or the exhaust stroke of cylinder #1, the JFI computer does not discriminate between the two.

- Step 11 Remove the top cover of the supplied distributor replacement trigger assembly. Note that the fine pitched wheel has two pairs of two teeth missing, exactly opposite each other. Turn the wheel such that the magnetic sensor is directly aligned with the 11th

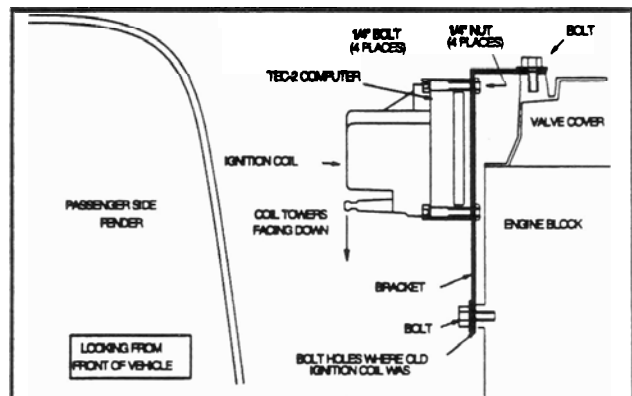


Trigger Assembly: Set base line timing.

tooth that follows the missing teeth as you turn the wheel clockwise. Either set of missing teeth will do. See timing wheel diagram. The air gap between the magnetic sensor and the trigger wheel is preset at the factory. Do *NOT* adjust or remove the sensor unless it is necessary. *IF* the sensor has been removed, set the air gap with a feeler gauge to 0.008". Note that the chisel shaped sensor point edge must be aligned vertically, parallel with the trigger wheel teeth. The body of the magnetic sensor has a black stripe. Use the stripe to help align the sensor tip. Note that the line is not exactly parallel to the sensor tip so use the stripe only as a guide.

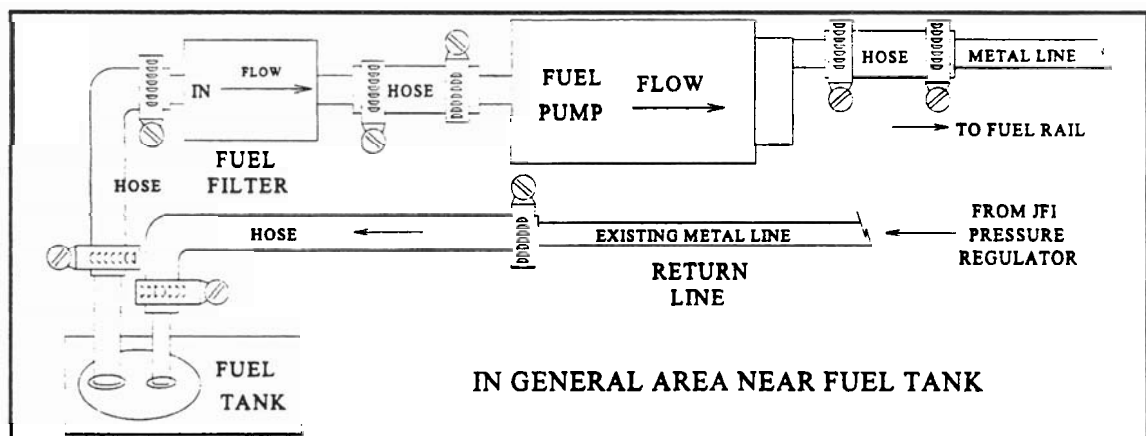
- Step 12 Look at the bottom of the trigger shaft and note the position of the oil pump drive; leave the wheel pointing at the 11th tooth - do *NOT* turn the shaft. With a long, flat blade screwdriver turn the oil pump gear in the engine, so that it roughly matches the position of the trigger shaft oil pump drive when the magnetic sensor is pointing toward the passenger side wheel (i.e. the sensor & wire do not point toward the engine). See the included diagram. Insert the distributor pick-up assembly into the distributor hole. Make sure that the oil pump engages and that the stop collar on the distributor housing seats down flush against the block. Caution: failure to follow these steps correctly may result in lack of oil pressure and could cause engine damage. If necessary, after the trigger assembly is down against the engine block, turn the housing slightly until the magnetic sensor again lines up with the 11th tooth as described above. Clamp the distributor down. Don't replace the cover until instructed.

- Step 13 Bolt the TEC to the included mounting bracket orienting the ignition coil towers down. Use the supplied $\frac{1}{4}$ " x $1\frac{1}{4}$ " bolts and nylon insert lock nuts. The bolts face the engine with the lock nuts behind the bracket. Mount the bracket on the engine using the original holes used to hold the ignition coil and by the appropriate two bolt holes on the valve cover. See diagram. On some model years it may be necessary to bend the engine oil dip stick tube to allow the dip stick to clear the TEC.



Detailed view of TEC mounted on engine

- Step 14 Install the supplied $\frac{3}{8}$ " hose between the PCV breather (back of engine on valve cover) and the hose nipple on the TBI air intake collar.
- Step 15 Install the fuel pump and fuel filter at the rear of the vehicle in a secure place, such as on a frame rail away from the exhaust. The included foam tape should be wrapped around the fuel pump to cushion contact with the included fuel pump clamp. Take care not to crush the pump with the mounting clamp. Note in diagram, the fuel filter is located *between* the tank and the pump. Installing the fuel filter is mandatory. Connect a

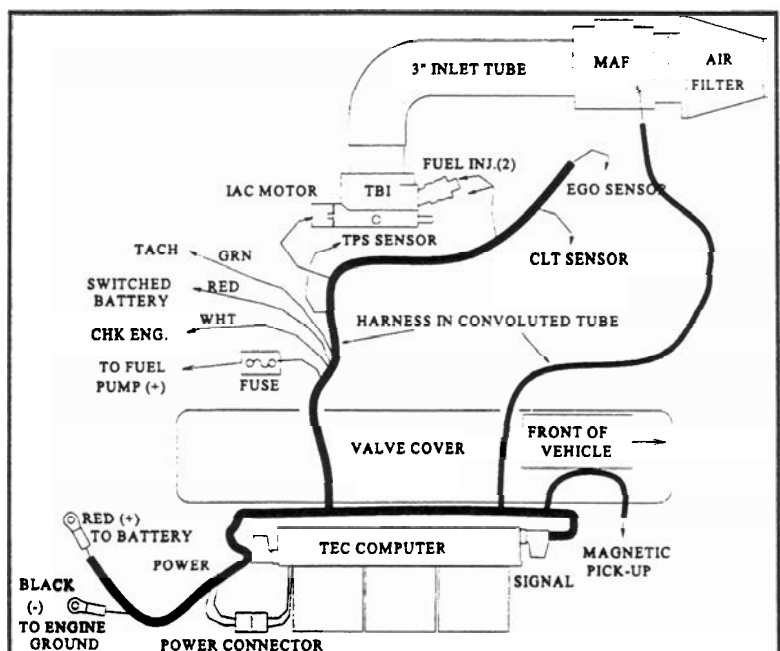


Fuel System Layout

ground wire to the pump negative (-), the narrow terminal with the supplied narrow fast-on electrical terminal. Attach the other end of the ground wire to one of the pump mounting bolts. For better electrical contact, clean an area on the chassis (frame) before mounting the pump. Due to the differences in vehicle models, the placement of the fuel pump is left to the installers discretion. In many applications, it works best to remove a section of the metal fuel line running along the frame rail and insert the pump and filter "in-line". Note the markings on the fuel pump and filter indicating direction of fuel flow. The pump outlet should be connected to the larger of the two existing metal fuel lines that run forward to the engine bay. The smaller metal line, the fuel return, should be connected to the dump tube on fuel tank. If your model year vehicle is not equipped with a return line, one *MUST* be installed. Use a tubing cutter and take care to clean the lines of any metal debris. Use a tubing flaring tool to add a small barb on the end of each tube. This will assure a strong connection to the fuel hose. Extreme care and common sense must be taken when ever working with gasoline. Have a proper fire extinguisher ready at all times. Take care to position the pump so fuel lines, electrical connections and the pump itself are protected from road debris. Secure all hoses and wires with wire ties. All fuel hose must be internally braided gasoline hose rated to 250 psi. Always use new hose. All hose connections must use a gear clamp. Caution: fuel system working pressure will be a high as 35 psi, so care should be taken to assure no leaks. Install other fuel hoses as required to complete the fuel plumbing at the rear of the vehicle. See the fuel system layout diagram for more information.

- Step 16 At the front of the vehicle, on the drivers side, install the included 5/16" fuel hose (and clamps) from the larger of the two metal lines (now connected to fuel pump output) to the brass nipple on the JFI Throttle Body fuel rail. Install a fuel return hose from the fuel pressure regulator outlet barb to the fuel tank return metal line. Again, some cutting and flaring of the lines may be necessary. Again, use caution routing fuel lines away from spinning accessories and the hot exhaust manifold.

- Step 17 Note the following when installing the wiring harness: Electrical connectors on the JFI wiring harness are keyed so that they only fit the appropriate mating connector. When routing the wiring harness avoid the exhaust manifold and sharp or pinching areas. The harness has two, 14 position, gang connector blocks that mate to the TEC. One gang connector is labeled SENSOR SIDE to match the label on the TEC. The other connector, next to the red and black power leads, is labeled POWER SIDE. Lay the wiring harness across the engine compartment with the gang connectors over the TEC. Route the harness around the engine compartment to reach the appropriate sensors as shown in the previous "Engine Compartment & Wiring Layout" diagram. Press the gang connectors into the TEC evenly and firmly. Note one connector is inserted "screws out" while the other is "screws in". Connect the 2 position (red and black) power connector from the harness to the TEC. For your information, the "JFI Wiring Diagram" shows the electrical schematic. A typical installation does not require the use of this wiring diagram. Make connections to Throttle Position Sensor (TPS), Coolant sensor (CLT), Idle Air Control (IAC) motor, Exhaust Gas Oxygen (EGO / O₂ sensor), magnetic pick-up, Mass Air Flow (MAF) sensor and fuel injectors. Wire tie the harness securely where necessary.



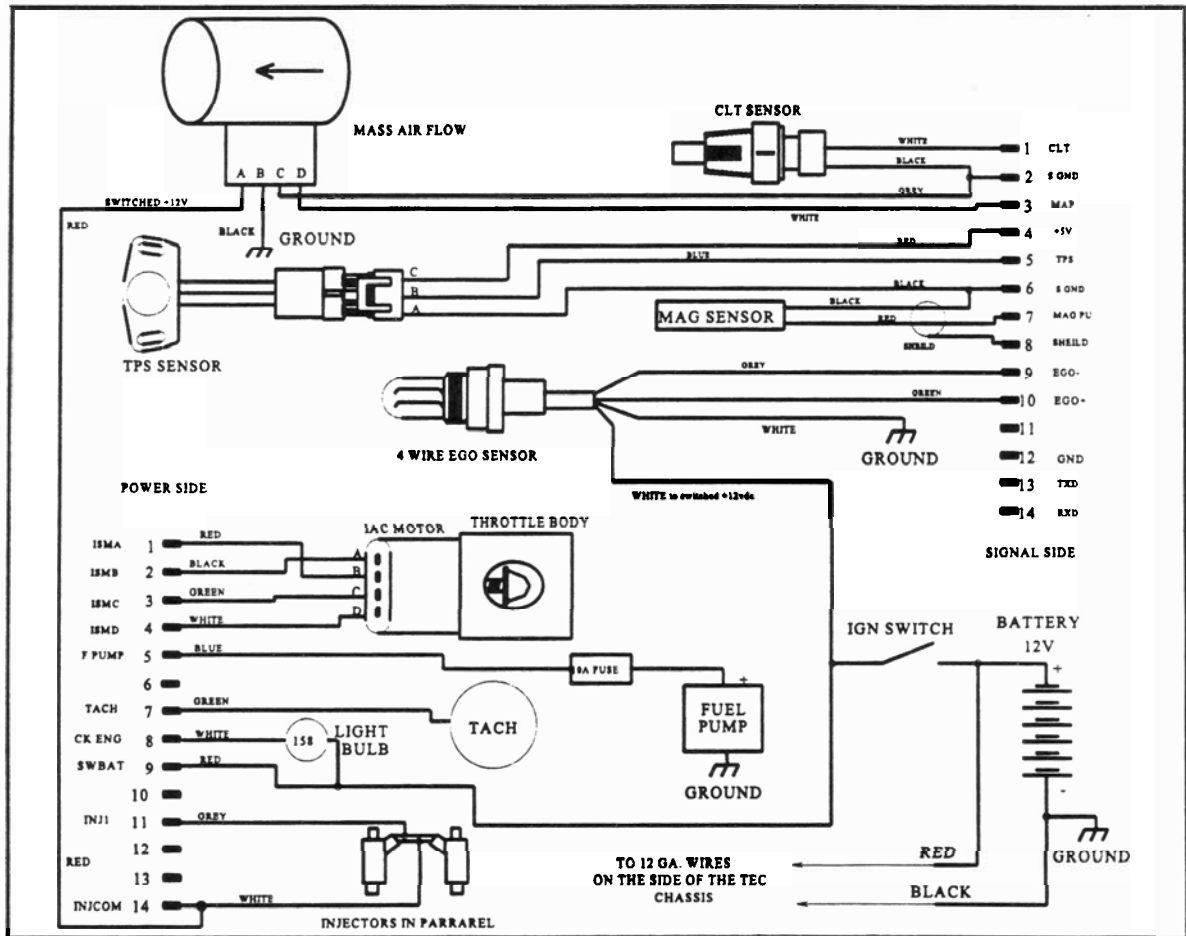
Engine Compartment & Wiring Layout

- Step 18 Exiting the harness, near the TEC are the 12 gauge red and black power leads. Connect the red wire to either the power distribution block on the firewall next to the battery or on the starter solenoid where the large, 4 gauge wire comes from the battery. Connect the black negative power lead to either the ground stud located on the passenger side of the engine block just below the TEC or on the old coil mounting screw. Verify your vehicle has the following ground straps:

- 1) ground cable from battery to engine block
- 2) ground wire from battery to chassis
- 3) ground strap from engine block to chassis

These grounds *are ALL* required. Install any missing grounds as necessary.

Note: The next 4 steps deal with the group of four wires exiting the harness between the TEC and the throttle body. Besides the larger red and black leads, these are the only wires that must be connected to the rest of your Jeep. Each wire is label appropriately. A splice kit is included with the JFI kit. When directed below, use the following procedure to make each connection: 1) strip approximately ¼" of insulation from both wires. 2) slide one piece of the included heat shrink tubing over one wire. 3) insert one wire inside the included silver connector and crimp that one end of the connector. 4) insert the mating wire inside the other end of the silver connector and also crimp. 5) Soldering the connection is optional but recommended. 6) center heat shrink tubing over connector and apply heat to shrink tubing.



JFI Wiring Diagram

- Step 19 The RED wire should be connected to vehicle SWITCHED BATTERY. This wire should have +12v when ignition is on and open (no voltage) when ignition is off. Make sure that this wire has +12v even when cranking. Some accessory terminals are "on" in the "run" position but "off" during "cranking". This will

prevent the engine from starting. Possible locations for the current power source include the old distributor connector or the PCV solenoid connector. Use a test light and turn the IGNITION SWITCH to off, on and start to check for power.

WARNING: Some models used a resistor wire for ignition coil +12v and this can not always be seen with a test light! This must **NOT** be used for switched battery.

- ☐ **Step 20** This step will identify what type of tachometer your vehicle is equipped with. Due to model year differences, there are TWO different types of factory tachometers. The JFI kit is designed to work with the "typical voltage" reading tachs and **REQUIRES REWIRING** to work with "current" sensing type tachometers. The factory OEM tachometer in *some* pre-1986 Jeeps are of the current sensing type. On these tachs, the "input" wire will actually feed 12v back into the JFI computer (TEC)! This can seriously damage the tach driver circuit in the TEC so follow these instructions carefully. Use the following tests to determine what type of tachometer is in your vehicle. On the old distributor wiring, find the OEM TACH wire. On most models it is a GREEN wire that was connected to the C- (minus) lead of the old coil. By the time the wire reaches the TACH it can be GREEN / WHITE or ORANGE. Review the coil wires you identified in step 2. Tachs can be identified by the number of wires entering the unit and by how the tach was wired to the OEM ignition coil. All factory OEM tachs have a two wires to operate the internal light (orange and black on most Jeeps). The "normal", voltage sensing electronic tach will also have *three* signal wires: +12v when key is on, a ground wire and signal wire from the MINUS lead of the coil (C-). This C- signal lead simply monitors the signal reaching the coil. Nearly all aftermarket tachometers are of this type and are compatible with the JFI kit. The current sensing tachs have *only two* signal wires: +12v when key is on and a signal wire to the POSITIVE lead of the coil (C+). This C+ signal lead is often red and a larger wire gauge size.

Do not connect the tach input GREEN wire from the TEC to the C+ terminal on the coil or 12volts. Damage to the TEC will occur.

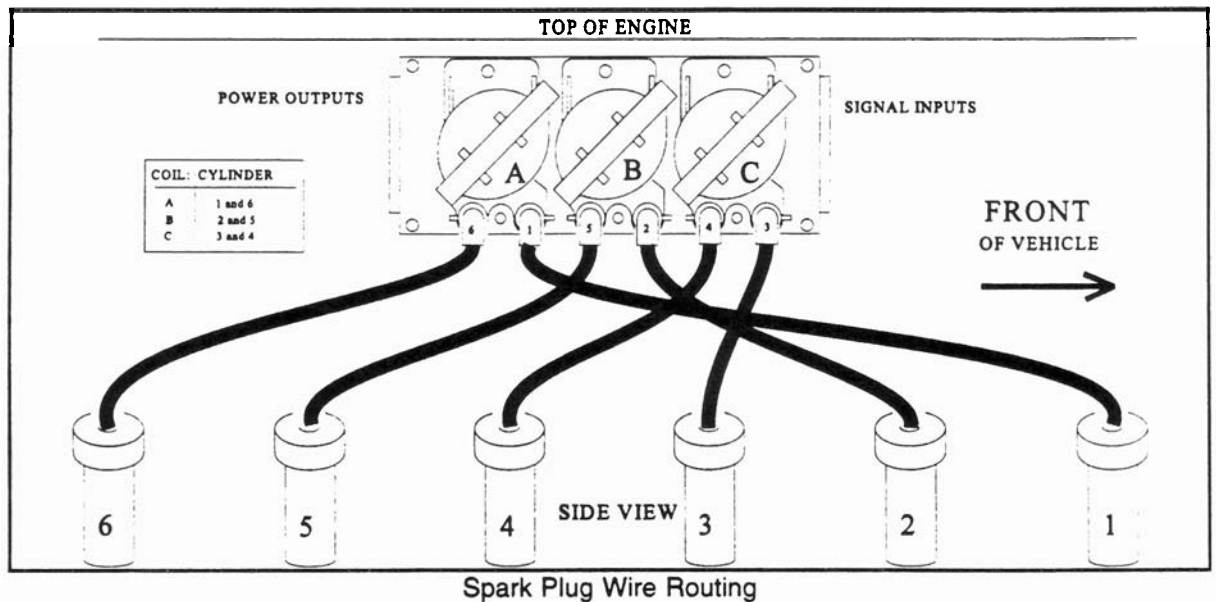
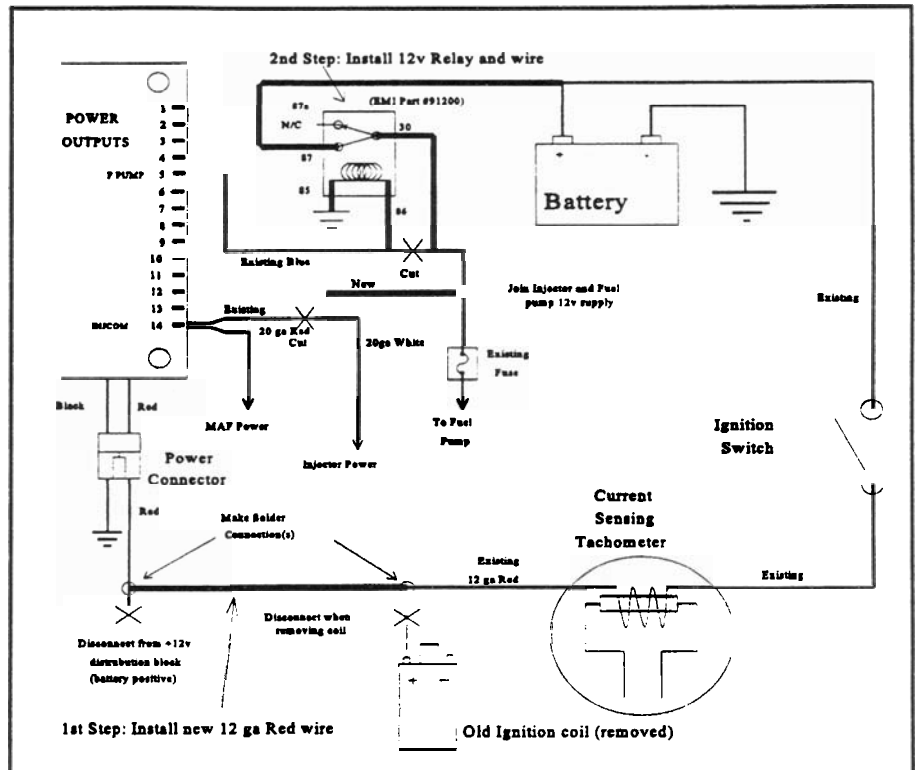
If necessary, consult the wiring diagram for your model year vehicle for more information

Please verify wiring *BEFORE* turning on power.

- ☐ **Step 21** Follow this step if your tachometer is the voltage sensing type (three signal wires / C- on coil), skip this step and follow the next step for installations with a current sensing tachometer. See the previous step to identify what type of tach you have.
- The GREEN wire exiting the JFI wiring harness next to the switched battery wire should be connected to your tachometer. On the factory distributor wiring, find the OEM tach wire. On most models it is a GREEN wire that was connected to the C- (minus) lead of the old coil. By the time the wire reaches the TACH it can be GREEN / WHITE or ORANGE. Review the coil wires you identified in step 2. The GREEN JFI tach wire connects to the wire originally on the C- (minus) of your factory coil. Crimp and solder as required. Remember to tape up all connections and unconnected wires with electrical tape.
- Even if your tachometer is of the voltage sensing variety, some older OEM electronic tachometers are not compatible with the electronic signal from the TEC even though they are on the C- lead of the coil. If your TACH needle lags engine RPM, jumps around or stays on zero when it should be indicating engine speed, your vehicle may require a special TACH AMPLIFIER from Electromotive (part #15210).
- ☐ **Step 22** Follow this step if your tach is the current sensing type (two signal wires / C+ & 12v), see the previous step for voltage sensing tachometer installations. See the previous steps to identify what type of tach you have. The installation a current sensing type tachometer is not nearly as easy as the voltage sensing type. As an alternative, you could replace your factory tach with an aftermarket unit. Almost all aftermarket tachs are compatible with the 0 to 12v signal put out by the TEC. Instead of connecting the large 12 gauge red wire directly to the battery, it must first pass through the tachometer. Connect the 12 gauge red wire from the JFI harness to the larger red wire that was on the C+ (positive) lead of your coil. This will complete the path through the tach as shown in the diagram. The current sensing tach also requires that the fuel pump and fuel injectors be isolated from the main TEC +12v power supply using an automotive grade (30A) relay. These relays are readily available from automotive parts supply stores and directly from Electromotive under part number 91200. Intercept the fuel pump wire between the fuse and the TEC (pin 5) and the wire between the injector common and the TEC (pin 14). Join these two wires together and supply with +12v through the

relay. The fuel pump output from the TEC (pin 5) is used to turn on the relay. See the attached diagram from more information.

- Step 23 The white CHECK ENGINE light wire also exits the harness next to the switched battery wire near the throttle body. This circuit operates a diagnostic light on the dash. Connect to a dash bulb or other indicating light with no more than 250 milliampere of burn current (no larger than a type 158 bulb). The other side of the bulb must be connected to +12v switched battery. On some vehicles, the grey wire running to the emissions reminder light is ideal. Type 158 bulbs are available at any auto parts stores.



- Step 24 The fourth wire runs the fuel pump. Note the in-line 10A standard automotive fuse in the water-tight holder. Attach the included 20 gauge wire and run it back to the positive (+) terminal on the fuel pump. The supplied pink fast-on terminal (larger of the two) is used to make the connection to the pump. Take the safest but most direct route inside the frame rail. Tie off the wire as necessary.

- ☐ Step 25 Spark plugs should be gaped 0.028" to 0.030". Attach ignition wires as shown in diagram. Note: It is Important to route distributor trigger assembly cable away from the ignition wires.
- ☐ Step 26 Refasten windshield water bottle and refill the engine coolant as required.
- ☐ Step 27 Attach air cleaner on the MAF sensor with the included gear clamp. Note arrow on top of sensor that indicates direction of air flow. Attach the included 3" dia air ducting to MAF sensor with included gear clamp. Position the MAF sensor and with air cleaner on either left or right fender close to the rectangular fresh air intake hole through the radiator structure. Orientate the air cleaner so the filter element itself is close to the inlet. This normally results in the MAF sensor body positioned so the air flow arrow is pointing up. Route the air ducting to the throttle body intake collar. Duct can be cut to length. Mark the position of the three sensor mounting holes and remove the sensor. Make a paper templet by tracing the bottom features on a sheet of paper. Tape the paper in position on the fender and drill three 1/4" holes through the paper and fender. Mount the sensor using the three included 6mm bolts. Connect air duct to outlet side of MAF sensor and to the intake collar on top of the throttle body. Ducting can be cut to length. Secure with included 3" gear clamps. Tie down the ducting in a few places to minimize bouncing. The structural rod running from the fire-wall to the radiator structure makes a good anchor point.

Starting Procedure

- ☐ Step 28 Turn the ignition switch to the RUN position, do *NOT* start engine. Observe the following:
 - 1) check engine light should come on
 - 2) Idle Air Control (IAC) motor should cycle once then stop; touch IAC motor & feel slight vibration
 - 3) fuel pump should run for 20 seconds then stop; feel for vibration or listen

Check entire vehicle for fuel leaks at this time.

WARNING: Fuel system pressure is now 35 psi. Repair all leaks before continuing.

If any of these three tests should fail, review all previous steps, rechecking all electrical connections. See trouble shooting section for more information. Remember not to over look the obvious, such as engine grounds and missed steps. Check mating connectors to assure all connections are complete.

- ☐ Step 29 Check Engine light should burn continuously with the key in the RUN position. If light starts flashing, see trouble shooting section for diagnostic codes. Note: it is not uncommon for a trouble code to show just after installation. This does not necessarily indicate a problem. It is very possible that the condition was taken care of during installation. Any logged intermittent codes will be cleared a later step.
- ☐ Step 30 Turn ignition OFF. No need to apply throttle when starting. Turn ignition to ON then to START, pause while engine spins up and then release key. Engine should start with-in a few revolutions. If engine starts, proceed to the next step. If not, try again and see trouble shooting section if necessary.
- ☐ Step 31 Allow engine to warm up then turn the key off. Insert a loop of small gauge (20) wire into the RXD and TXD pins on the signal side connector of the TEC (pins 13 & 14). Screw down the connector firmly...no need to over tighten. When the engine is started, this "jumper" wire will force engine timing to ZERO and clear any stored intermittent trouble codes. Connect a timing light on cylinder 1 pointed at the TDC mark on the factory balancer. Do not use the "dial back" feature of a timing light since the double firings will often give false readings. Use a standard timing light (or a dial-back light set at "0 degrees") and look at markings on the crankshaft. The factory timing mark should be aligned at ZERO degrees. Start engine. Note that a cold engine may have a rough idle during this procedure. If the timing light does not exactly indicate spark timing is at ZERO degrees advance then loosen the distributor hold down clamp (with vehicle running) and rotate the pick-up assembly so the timing reaches ZERO degrees. Tighten the hold down clamp and recheck timing. Turn off the ignition and remove jumper and timing light.
- ☐ Step 32 Restart engine and observe idle speed. A warm engine should idle at 800 ±50 rpm. If engine speed is not stable within this range, see the trouble shooting procedures below.
- ☐ Step 33 If the Jeep does not stop running when the key is turned off, install the included diode in series with the small brown wire which enters the white connector on the back of the alternator. Silver line on the diode

indicates the lead which goes to the alternator. Cut the wire at the alternator and splice in series. Solder connections and cover with electrical tape.

- ☐ **Step 34** When everything checks out and all instructions have been followed, clean off an area next to the original emission label and place the included Electromotive tune-up and emission label. Install cover on trigger assembly with the 3 included 4-40 screws.

Service Notes

1. Unless otherwise stated below, follow OEM recommended service maintenance procedures and intervals.
2. Once TDC timing (see step 29) and throttle position (preset at factory) are set, there are no adjustments for idle speed or timing.
3. This kit takes into account that the engine is mechanically in good shape; no vacuum leaks at the intake manifold and no leaks at the exhaust manifold.
4. The spark plugs should be gaped at 0.026" to 0.030".
5. The supplied air cleaner is a high flow, reusable filter. It should be cleaned every 20,000 miles or when visually dirty. Use warm, soapy water and air dry. Do not use solvents or compressed air. When dry, Re-oil using only commercially available air filter oil intended for air filter use.
6. The following service items are particular to the JFI kit. These components are available from your local auto parts store or directly from Electromotive:
 - Fuel filter: Fram G-3 or AC GF-61M (local auto parts store)
 - Air filter: JFI401 (Electromotive)
 - Plug wires: exact replacement part: JFI402 (Electromotive)
similar replacement part: 606G (AC Delco) or 74313 (Autolite)

Trouble Shooting

This troubleshooting guide is to help you perform basic diagnostics after you have double checked all of the above installation instructions. The following assumes that the engine is in good mechanical working order.

If the engine is running and a sensor malfunction has occurred for more than one half second, the TEC will store a trouble code. When the ignition is ON and the engine is NOT rotating, any codes will flash on the check engine light. Read the code(s) by counting the one second long flashes. If more than one code is stored, a three second pause will occur between flashes. The code(s) will continually repeat until they are cleared or the engine is cranked. With the engine running, a current hard failure is indicated by a steady burn of the light, indicating a problem that must be diagnosed and serviced. To clear codes after repair, use a short 20 gauge wire to jumper the RXD to the TXD on the TEC (pins #13 & #14) with the ignition off. Then turn the ignition on for a few seconds and then off...remove the jumper. Note this jumping is also used for checking spark timing.

Diagnostic Failure Codes			
Flashes	Failure	Flashes	Failure
1	Coolant Temperature sensor (CLT)	4	Exhaust Gas Oxygen (EGO) lean too long
2	Not applicable (should not occur)	5	Throttle Position Sensor (TPS)
3	Mass Air Flow sensor (MAF)	6	Low Battery Voltage (LOB)

Problem Descriptions and Solutions

Symptom: "Engine Cranks but Won't Start or Fire"

- Check:** Spark is operating during cranking. To verify plugs firing, use a clip on inductive timing light on each plug wire to see if it strobes the timing light. In the absence of a timing light, remove the spark plug wires from each coil and crank the engine. Spark should jump between the towers of each coil. Do not spark more than a few times, as the coil insulation can be damaged. Reattach spark plug wires in correct sequence.
- Fix:** If the plugs are not firing, check and set *only if necessary*, the magnetic sensor for the correct air gap (0.008"). Also check the teeth of the pick-up wheel and repair or replace if damaged. The run out of the wheel should not exceed 0.002" TIR. Note the edge of the chisel point end of the magnetic sensor must be vertical inside the trigger assembly, aligned with the teeth.
- Check:** Open Sensor lead: With an Ohm meter, measure the resistance between the Red (pin A) and Black (pin B) wires when looking into the sensor side of the distributor pick-up sensor connector. It should normally read between 600 and 800 ohms.
- Fix:** Check for broken or burnt wires and for bad connector. Replace sensor/wiring/connector as necessary.
- Check:** Fuel is being delivered during cranking. Verifying fuel flow can be difficult. It is hard to observe (feel or hear) the injector firing because of the need to run enough air through the MAF sensor. You may try by attaching a 12 volt indicator light or fuel injector tester between the two fuel injector leads and observing flashes during crank. As a test, remove air intake duct and watch for fuel spray onto the throttle plates. Always use caution around gasoline vapors. After extended cranking check to see if spark plugs are wet. If so, clean and dry before reinstalling. Check if fuel pump is running. When the ignition key is first turned to the run or start position the fuel pump should start and, if the engine is not started, will stop after 20 seconds. The pump should be audible under the vehicle. Check the 10A fuse in the water proof fuse holder in the wiring harness near the throttle body.
- Fix:** Replace fuse with 10A max. If fuse immediately blows, check wiring for possible shorts. A clogged fuel filter can blow fuse. Replace filter.
- Check:** Engine can be starved for fuel if vapor lock or cavitation occurs. This can occur between the tank and fuel pump and even inside the fuel filter. Check for fuel line restrictions, sharp bends, collapsed tubing or hoses.
- Fix:** Replace and/or reroute fuel lines as required. Replace fuel filter. Fill fuel tank. A full fuel tank will decrease the possibility of vapor lock and cavitation. Fresh, high quality gasoline can also help.
- Check:** With a voltmeter, observe the battery voltage. With the engine off, it should read 11.0 to 12.5 Volts. When cranking the engine over, it should read no lower than 10.0 volts. When the engine is running with a an alternator, it should read 13 to 16 volts.
- Fix:** If not, recheck, replace or clean all wiring, alternator and connections. Replace battery if necessary. If battery is only low, a battery charger can be used to "jump start" but use caution. *Never* attempt to use a battery charger without a functional battery installed in the vehicle.
- Check:** Slow revving starter motor.
- Fix:** Check battery voltage during cranking. Rebuild or replace starter motor as required. Replace motor with faster cranking model. Clean all electrical contacts and motor brushes. Verify battery wires are heavy gauge to handle cranking current. Use lighter engine oil, especially in new engines.

Symptom: "Engine shows fuel and spark is occurring but no start"

- Note:** If the plugs are firing and wires are in the right sequence, fuel delivery must be insufficient to start the engine.
- Check:** For fuel injector operation. This can be done while cranking by listening for a faint clicking noise or by feeling them. A fuel injector test light is often necessary to observe injector firing at cranking speeds. Remove a sparkplug to see if it is wet with fuel.
- Fix:** With key on, +12 volts must be reaching one terminal of each fuel injector. Repair this wiring as necessary.
- Check:** That fuel pump turns on for 20 seconds when ignition is turned on and that pressure is sufficient (approximately 35 psi). Note that the 35psi is a differential pressure reading. When engine is running and producing a vacuum, fuel pressure read with a gauge will indicate less. This is normal.
- Fix:** Replace fuel regulator or fuel pump if unable to produce 35 psi or if they have failed. Check for fuel leaks on the pressure side of the pump and air leaks on the vacuum side. Check for clogged fuel filter. Replacement fuel filter is Fram G-3 or AC GF-61M. Check if the fuel supply and return lines are swapped.

Symptom: "Engine fires but runs poorly, erratically or dies at high RPM"

- Check:** All sparkplug wires must be on and in the correct firing order stated in the spark plug wiring section. Check for shorts or burns through the insulation.
- Fix:** Adjust the wires to the correct firing order. Replace Wires as required.
- Check:** The sparkplug wires must have a resistance of 2500 ohms per foot or greater.
- Fix:** Use only the supplied spark plug wires or OEM grade resistor core wires. Replace plug wires with same high quality wires that came with kit by contacting Electromotive. In an emergency, standard production car 8.0mm GM radio suppression wires are suggested. See service notes for suggested "best fit" part numbers.
- Check:** Ballast resistors must not be in the switched battery (pin 9) circuit. Some stock vehicles have a resistance wire between the coil B+ and ignition switch. Inadequate +12v supply. Poor ground to engine block.
- Fix:** Replace wire with 12 gauge copper hookup wire. Add ground from the unit to engine block.
- Check:** Age of battery, damaged battery or poorly charged. Loose lead plates in battery from vibration.
- Fix:** Replace battery, gel cell type batteries work very well and are more resistant to vibration.
- Check:** Both power and signal connectors are firmly installed in the TEC and that no wires have broken loose.
- Fix:** Press connectors into the TEC. Remove broken or damaged wire, strip back and reinsert into connector.
- Check:** The sensor and pick-up wheel must be installed accurately according the installation instructions. Check the mechanical timing with a timing light using the procedure outlined in the "Starting Procedure" section. The mechanical timing can also be checked physically by removing #1 sparkplug and checking piston position. When #1 piston is at TDC the sensor should be aligned with the 11th tooth. Check run out of the wheel. Look for damaged teeth. The sensor bracket must not vibrate at high speeds. Check mechanical timing with a timing light at cranking speed by turning the fuel off. Check the wiring of the magnetic sensor connectors.
- Fix:** Realign sensor and wheel according to installation procedures. Replace sensor or wheel.

Check: The trigger wheel must be set according to the instruction manual. A miss-timed trigger could cause low power. Do not use a "Dial Back" timing light since the double firings will give false readings. Use a standard timing light or a dial-back light set at "0 degrees" and look at markings on the crankshaft.

Fix: Study how to calibrate the unit from this manual and improve the base line timing.

Note: When using a timing light, only one of the plug wires attached to any coil goes positive, the other goes negative. If your timing light won't fire correctly or produces extra jitter change the pick-up over to the other spark plug wire on that given coil. At a steady RPM, the spark timing should be extremely stable.

Check: The screws holding the coils down to the baseplate. They must be tight to ground the coil inner steel.

Fix: Tighten screws, replace star washers, clean corrosion.

Check: Fuel mixture too lean during higher power running.

Fix: Leak in air intake after MAF Sensor. Repair leak as necessary.

Check: Injectors or MAF too small producing fuel starvation at high speed.

Fix: Due to significant engine power modifications such as cam and head changes injector flow rate must be increased. Call Electromotive.

Symptom: "Engine runs but has poor idle quality or oscillates at idle"

Check: Air leaks after the MAF Sensor makes the mixture too lean.

Fix: Check gaskets and clamps for leaks. Use stethoscope or carb cleaner method. When checking for vacuum leaks, disconnect IAC motor wiring connector.

Check: Excessive air flow through PCV valve fools MAF Sensor into making the mixture too lean. Piston ring sealing, excessive oil consumption and general engine wear can all effect idle quality.

Fix: Replace PCV valve with 1987-90 model. Repair or rebuild engine.

Check: Poor or erratic MAF signal from poor placement of MAF sensor.

Fix: The MAF sensor, ducting and air filter must be installed as intended with this kit. Sometimes, a straight section of air pipe must be used before and after the MAF.

Check: Mixture too rich at idle or low power.

Fix: EGO has failed lean, replace sensor.

Check: Vacuum leaks can occur in many places. Any air leaks downstream from the MAF sensor can cause serious driveability concerns due the mass air flow nature of this kit.

Fix: Have a qualified automotive mechanic perform the standard checks for air leaks around the base of the throttle body, in the vacuum lines, at the intake manifold mounting gasket on head, around the EGR valve mounting flange and the EGR diaphragm itself. It may be necessary to re-torque the intake manifold bolts to the head and/or replace the intake manifold gasket. When checking for vacuum leaks, disconnect IAC motor wiring connector.

Symptom: "Engine runs rich at idle and then leans out at light load part throttle"

Check: Radical camshaft produces poor volumetric efficiency at closed throttle thus giving erratic MAF signal.

Fix: Kit was not designed for significant engine modifications.

Check: Thermostat for proper operation. Temperature when thermostat opens.

Fix: Replace as necessary with a 195°F thermostat.

Symptom: "Engine Runs on when Ignition is turned off"

Check: Alternator field current is still flowing.

Fix: Install the included diode in series with the small brown wire which enters the white connector on the back of the alternator. Silver line on the diode indicates the lead which goes to the alternator. Cut the wire at the alternator and splice in series. Solder connections and seal with electrical tape.

Symptom: "Tachometer lags engine, reads zero or jumps around"

Fix: Some tachometers are not compatible with the electronic tach drive output of the TEC. Purchase a Tach Amplifier module from Electromotive (part #15210).

Symptom: "Check Engine light does not illuminate"

Check: Bulb burned out or hooked up wrong. Try touching the wire which was connected to the Check Engine output to ground. The light should illuminate if the key switch is on.

Fix: Replace light bulb. Check wiring: the other side of the light bulb is attached to +12 volts switched battery.

Symptom: "Idle speed below 700 or above 900 rpm OR does not control"

Symptom: "Engine stalls on hard deceleration"

Check: IAC motor is inoperable, PCV valve is stuck open, TPS voltage at idle is too high and/or charcoal canister is choked.

Fix: Replace PCV or Charcoal canister as required

Fix: Perform throttle idle stop setting procedure as outlined below:

- 1) Start and run or drive vehicle until engine is warm. Turn off engine.
- 2) Disconnect TPS sensor from harness.
- 3) Back off the lock nut on the throttle stop screw.
- 4) Start engine and wait 30 seconds.
- 5) Slowly turn throttle stop screw inwards to increase idle speed to approx 1000rpm. Wait 5 seconds.
- 6) With engine still running, disconnect IAC motor connector from harness.
- 7) Slowly turn throttle stop screw out to decrease idle speed to 700 rpm. Turn off engine.
- 8) Tighten the lock nut on the throttle stop screw without rotating the stop screw.
- 9) Verify key is off, reconnect the TPS sensor and the IAC motor connectors.
- 10) Turn key on, check engine light should indicate a intermittent failure of the TPS.
- 11) Restart engine and observe idle speed is now approximately 800 rpm. Turn key off.
- 12) To reset intermittent failure code, jumper TXD (pin 13) & RXD (pin 14) on TEC input connector.
- 13) Turn key to on (do not start engine). Wait three seconds. Turn key off. Remove jumper.
- 14) Follow TPS idle voltage check procedure listed below.

Fix: TPS idle voltage check procedure:

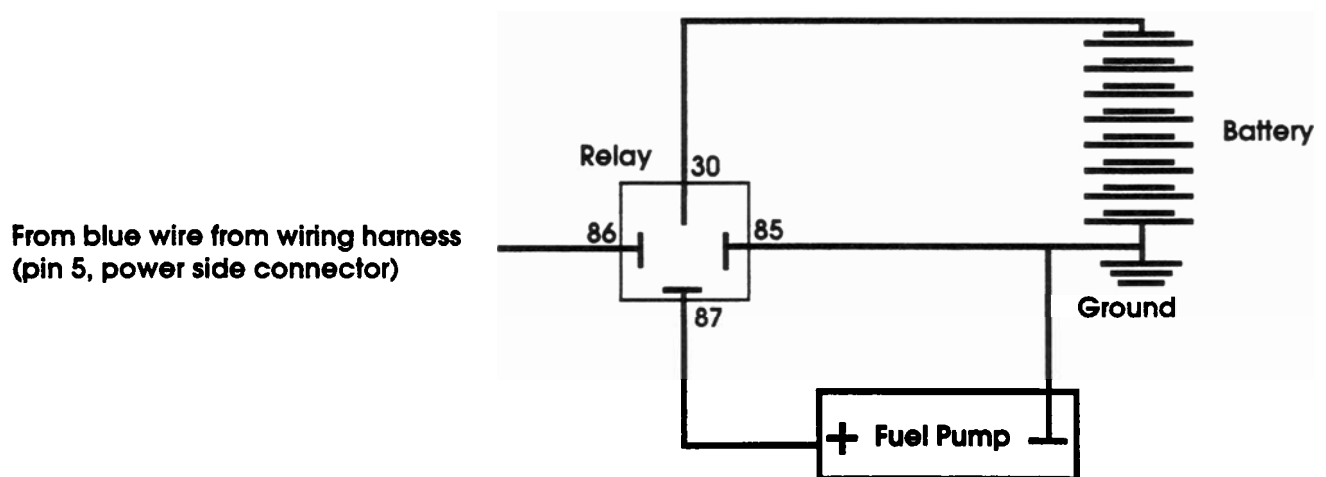
- 1) Turn key on but do not start engine.
- 2) Using a DC volt meter, measure the TPS voltage at the TEC signal input connector. Put RED probe (positive) on pin 5 (TPS signal) and BLACK probe (negative) to pin 6 (GND).
- 3) With the throttle at idle, voltage should be at least 0.68 volts and not more than 0.75 volts.
- 4) If not, loosen TPS bolts slightly and rotate body to indicate correct voltage.
- 5) Tighten TPS bolts. Recheck TPS voltage; readjust as necessary.

Note: Do not adjust idle stop to correct the TPS voltage! Use above adjustment procedure.

Addendum to the JFI Installation Instructions

JFI kits are now supplied with a new fuel pump and a relay. The included parts are:

- fuel pump
 - relay
 - 10' 12 ga. wire with connectors
- ❑ Mount the pump to the frame rail next to the fuel tank using the supplied hardware. Make sure the pump is mounted with the inlet below the outlet at a 15° angle (approximately).
- ❑ Using 3/8" fuel line, install the pre-filter between the fuel tank and the fuel pump.
- ❑ Using the 5/16" fuel line, plumb the output of the fuel pump to the fuel rail on the throttle body.
- ❑ Use the relay and the supplied 12 gauge wire to power the pump as shown below.



Electromotive, Inc.

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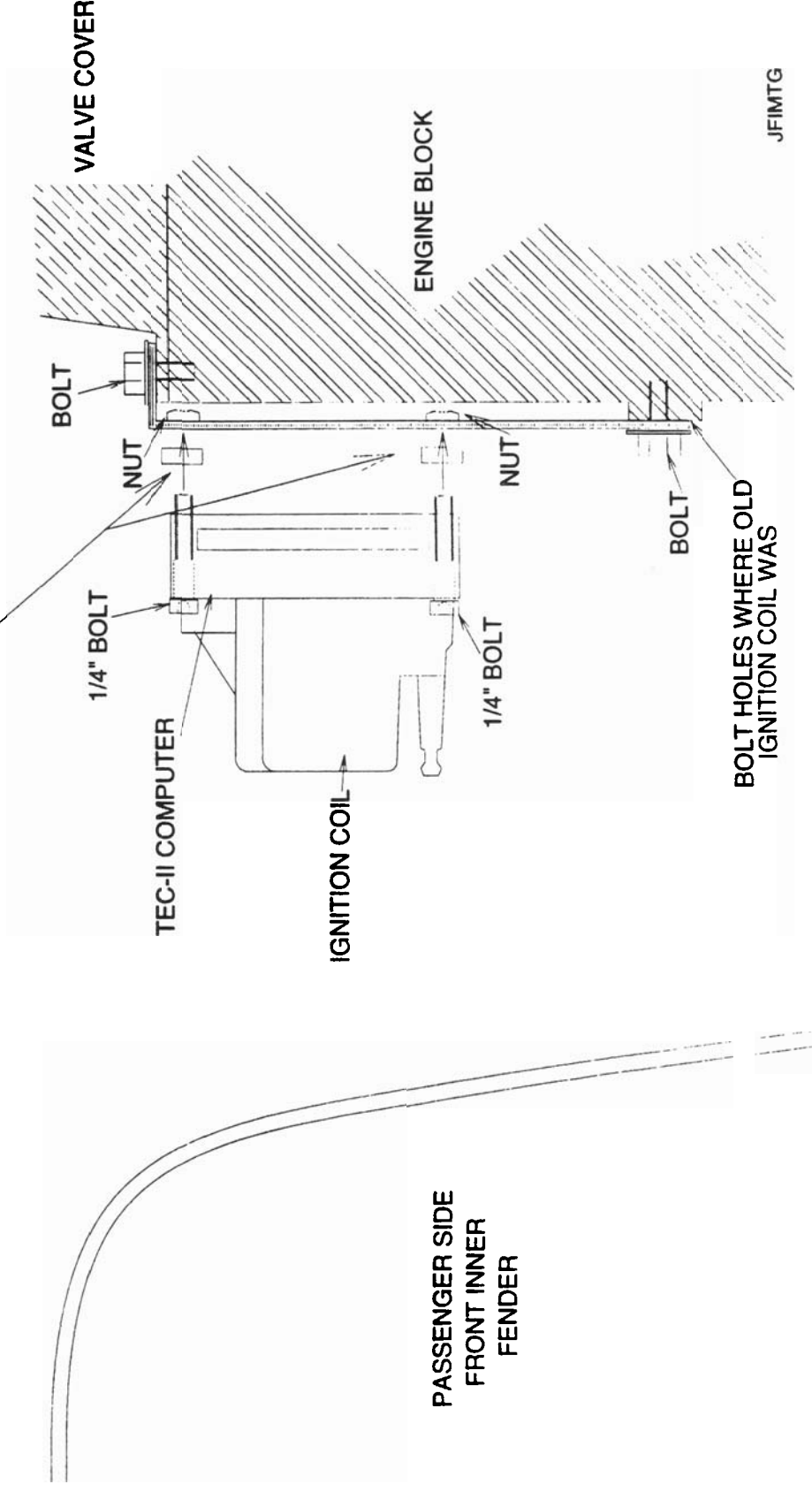
(703) 331 - 0100 FAX (703) 331 - 0161

<http://www.electromotive-inc.com> e-mail: tecinfo@electromotive-inc.com

Addendum

When installing your JFI unit, place the provided nylon spacers on the bolts between the JFI unit and the mounting bracket. Be sure to use one spacer on each of the four mounting bolts.

Nylon Spacer



FRONT VIEW OF TEC MOUNTING

Jeep 258 cid Crank Trigger Installation

Introduced in April of '99, the 258 Crank Trigger Kit is designed to fit the 4.2 liter AMC/Jeep In-line six cylinder found in many CJ's and YJ's.

Parts List

1. 7.25" 60 minus 2 tooth Trigger Wheel
2. Aluminum Trigger Wheel Spacer Hub
3. Bolts, Washers, etc.
4. Magnetic Sensor Bracket
5. Spacers for Magnetic Sensor Bracket

Place the engine on T.D.C. of Cylinder #1
Remove the 3 bolts holding the front pulley to the balancer.



Fig.1

Fig.1 Remove the Bolts on the passenger side lower part of the engine block.

Install the Mag. Sensor Bracket, and Spacers

Fig.2 Clean the front surface of the pulley to ensure a clean fit of the Trigger Wheel Spacer Hub.

Fig.3 Using the new Bolts, install the Trigger Wheel over the hub, and with the hub in the center of the pulley onto the balancer, so that the TDC Mark appears close to the Magnetic Sensor. *Do not tighten the bolts at this time.*

Align the trigger wheel and magnetic sensor so that the trailing edge of the 11th tooth after the gap is directly under the magnetic sensor's center point.

Fig.4 Allowing .050 to .075 inches of clearance between the sensor and wheel, tighten the assembly.



Fig.2 Viewed from Underneath

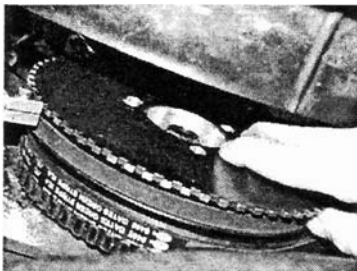


Fig.3 Viewed from Underneath

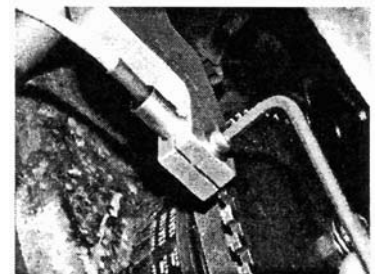


Fig.4 Viewed from Underneath

NOTE:

This New Trigger Wheel Profile allows for a larger sensor gap. However, the larger the sensor gap, the more susceptible the system is to EMI/RFI noise.