

HOWELL

ENGINE DEVELOPMENTS, INC
FUEL INJECTION APPLICATIONS

INSTALLATION MANUAL

Model JP-1 EFI Kit
for
JEEP 258 CID (4.2)
6 Cylinder Engines
(1972-1991)

THIS KIT IS LEGAL TO SELL, DISTRIBUTE AND INSTALL ON VEHICLES
CALIFORNIA UNDER CARB EXECUTIVE ORDER (E.O.) D-452

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**INSTALLATION INSTRUCTIONS MODEL-JP-1
TWO BARREL THROTTLE BODY FUEL INJECTION ON JEEP 6 CYLINDER
258 CID IN-LINE ENGINES**

The HOWELL Jeep EFI kit uses a new General Motors throttle body fuel injection unit from the 4.3L V-6 engine to replace your existing Jeep carburetor. It is fitted to the stock Jeep intake manifold with an adaptor supplied in the kit, and controlled by a GM vehicle ECM (computer) using a coolant sensor, MAP (Manifold Absolute Pressure) sensor, and heated Oxygen sensor for input information. These components allow your Jeep to operate at the correct air/fuel ratio for minimum emissions, best power, and good fuel economy. This kit provides improved starting, both hot and cold, and immediate drive away without lengthy warm-ups. Off-road maneuverability is greatly improved by eliminating troublesome stalls due to flooding or fuel starvation.

In addition to the above improvements, the TBI kit simplifies the under hood area by removing many of the vacuum hoses and vacuum controlled emission devices formerly required to meet emission standards with the OEM carburetor. These are no longer required due to the advanced engine control system capable of better pollution control, in addition you enhance durability due to the use of genuine GM late model components that have been developed and thoroughly tested by GM as OEM parts on the 4.3L V-6 engine. With the JP-1 EFI kit, your Jeep will meet all EPA guidelines and California Air Resources Board (CARB) requirements up through Model year 1991 by qualifying for CARB EO (Executive Order) D-452. This makes it legal for distribution and installation in all 50 states.

NOTE: TO BE FULLY EMISSION LEGAL, YOUR JEEP MUST HAVE A PROPERLY FUNCTIONING CATALYTIC CONVERTOR, EGR VALVE, CANISTER AND PURGE SYSTEM, PCV VALVE, AND A VEHICLE SPEED SENSOR INCORPORATED INTO THE SPEEDOMETER DRIVE CABLE THAT TRANSMITS VEHICLE SPEED INFORMATION TO THE ECM.

The under hood vacuum diagram included with this kit is based on a 1990 Jeep Wrangler. Earlier model years will vary slightly, but all circuits are required to be emission legal.

Kit Components:

1. Two barrel TB unit with integral TPS and Idle Air Control. (JP-1 kit has E.O. # tag)
2. Electronic Control Module (ECM) GM PN 1227747.
3. Howell wiring harness- connecting engine to vehicle ECM.
4. Calibration Prom matching TB to Jeep 258 CID in-line engine. (inside ECM)
5. Cal-pack (L-6), for limp-home operation (inside ECM).
6. Manifold vacuum sensor (MAP), GM PN 16165793
7. Engine coolant sensor for ECM control, GM PN 25036979
8. Exhaust Oxygen sensor & 18MM mounting bung. Single wire oxygen sensor GM PN 25166816.
JP-1 Kit has heated oxygen sensor GM PN 25312184.
9. Electric fuel pump--high pressure, in-line, HED PN FP 257
10. High flow fuel filter, in-line, Fram PN G3802A
11. Fuel line kit.
12. Fuel pump relay, GM PN 14089936
13. Vehicle Speed Sensor, HED PN VSS263 (JP-1 Kit only)—Page 8, Section 5
14. Small parts kit for routing and mounting components.
15. Service manual-basic troubleshooting and operating information.
16. Under hood label Vacuum Diagram and E.O. ID. (JP-1 Kit only).

THIS SYSTEM IS BASED ON THE PRODUCTION GM (Chevrolet or GMC) THROTTLE BODY FUEL INJECTION AND ELECTRONICS, USED FROM 1986-91, ON 4.3 V-6 ENGINES. ALL BACKUP SYSTEMS AND "ON VEHICLE" DIAGNOSTICS FUNCTION SIMILAR TO THOSE MODEL YEAR PACKAGES. THIS SYSTEM DOES NOT CONTROL SPARK TIMING AS ON GM ENGINES BUT RELIES ON A TACH SIGNAL FROM THE JEEP ELECTRONIC IGNITION FOR RPM INPUT TO THE ECM.

Installation procedure will be separated into the following categories:

1. Preparation of Jeep for TBI installation.
2. Removal of non-required parts from carbureted engine.
3. Installation of TBI and engine hardware.
4. Installation of Electronic components and wiring harness.
5. Calibration PROM and vehicle ECM.
6. Initial vehicle startup and operation.
7. Initial driving impressions.
8. Tuning and troubleshooting.

PREPARATION OF JEEP FOR TBI INSTALLATION

The HOWELL JEEP EFI 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. Before starting the actual installation, take the time to read these instructions completely. 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 an 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 amount of time it takes to install the kit may vary between 6-12 hours.

The Jeep has evolved during the years covered by this kit (1972 to 1991). Although these kits are engineered to work on all model years, your vehicle may deviate somewhat in general arrangement and general controls. Obviously an engine with a one-barrel carburetor will have to be updated with a later model intake manifold. Different harness designs are available for CJ models, and 1986 and later Wranglers. The engineering and emission test mule for this kit was a 1990 Wrangler.

NOTE: On pre 1981 (non-computer controlled or aftermarket exhaust) vehicles you may choose to install the Oxygen sensor described in paragraph 4 of the component installation instructions first, if it is to be done by an outside source.

1. Raise hood to allow access to top of engine, and disconnect the battery
2. Most Jeeps are tall enough to just simply crawl underneath without raising the vehicle. If not jack up left side of Jeep and support with jack stands. Raise high enough to allow access to the LH frame rail and main fuel line to enable fuel pump installation in this location. Some earlier model Jeeps will require the right side of the vehicle to be raised for pump access. Fuel lines usually run down the frame rail on opposite side of the exhaust system.

REMOVAL OF NON-REQUIRED PARTS FROM CARBURETED ENGINE

- a. Remove the mechanical fuel pump from the carbureted engine. Install the supplied fuel pump block off plate and gasket from your kit.
- b. Remove and discard the air cleaner (Thermostatic Air Cleaner System-THERMAC).

- c. Remove all vacuum lines and connectors from carburetor, only 2 will be re-connected as indicated by an asterisk: *
 - Idle solenoid vacuum line
 - 4in. Hg (beige) vacuum switch connector
 - Carburetor bowl vent line to canister (plug canister nipple)
 - PCV/Canister vacuum line *
 - Thermal vacuum switch and distributor advance vacuum line *
 - Stepper motor connector
 - WOT switch connector
 - Electric choke heater connector
 - Throttle return spring

- d. Remove and discard the fuel line and filter from fuel pump to carburetor.

- e. Disassemble remaining vacuum lines and air pump hoses, if so equipped, and the following emission controls:
 - Upstream check valve, and Downstream check valve, pulse AIR system or air pump on early models and diverter valve.
 - Decel valve and bracket
 - 4 & 10 in. vacuum switch assembly
 - PCV solenoid
 - Knock sensor
 - Upstream, Downstream & Idle solenoid bracket
 - Air cleaner stud bracket- (from rocker cover)
 - Throttle return spring bracket
 - Fuel line bracket on block

- f. Remove fuel and vapor return line from Jeep fuel filter to the point where it attaches to metal return line on driver's side of Jeep.

- g. Remove the carburetor. Make sure the carburetor- mounting surface is clean and free of any gasket material. Cover open manifold to keep out debris. When finished, your engine should look like **FIGURE 1**.

- h. Remove main fuel line from support brackets along the frame rail on the driver's side of vehicle. Earlier models will remove main fuel line support brackets from top of frame rail near oil filter and under passenger side of vehicle.

- i. Cut main fuel line (with a pipe cutter) approximately 2" back of the rear side of the transmission shield, and discard forward line. Be sure to have some sort of plug to temporarily seal off the fuel line, until fuel pump is installed, fuel will continue to leak if not plugged.

INSTALLATION OF TBI AND ENGINE HARDWARE

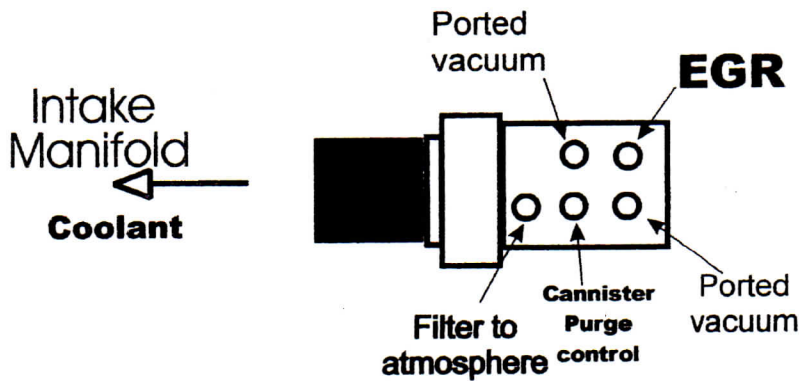
1. Install the supplied 2-barrel adaptor plate, (**FIGURE 2**) using the Jeep 2 barrel carburetor gasket. Use gasket and cap screws supplied. Note the intake manifold heater (on late models only). When your engine is running and below 160 deg F, the heater should be on to maintain

good drive ability and help reduce emissions, this heater system **must** remain installed and functional. As an alternative, it may be wired directly to 12-volt power source.

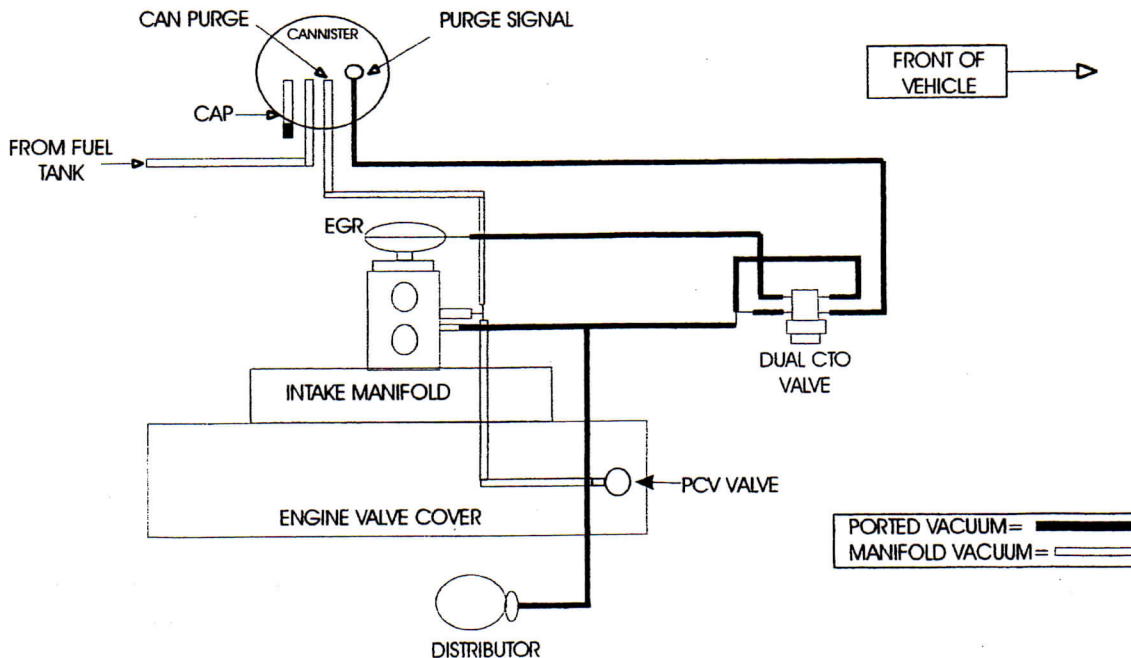
2. **NOTE: MOUND** a sufficient amount of automotive RTV sealer on **the TOP** of each Allen bolt head (a 1/4"-3/8" mound) and allow to set up, for at least 4-24 hours, if possible, so there will be no vacuum leaks. Install the TBI unit with the supplied gasket and hold down bolts.
3. Revise and connect vacuum lines as shown on the following vacuum diagram, using the previously removed vacuum lines and plastic tees as required. The canister, located under the washer fluid bottle has 4-vent tubes. (EGR may be maintained as factory on earlier model, non-emission legal kits). On JP-1 and emission legal kits, the Dual CTO valve ports are shown in the figure below. All vacuum ports on TBI unit are lettered on the actual TBI unit. For earlier model Jeeps without Dual CTO valve, you must acquire an OEM part, PN-J3238932, also available under Standard PN-PVS61 or at CARPARTS.COM website.

The Dual CTO valve is used in the JP-1 CA. legal kits only, if you do not have the CA. legal kit you do not necessarily have to run the Dual CTO valve. The stock CTO valve systems can be used as they were from the factory or they can be eliminated on the non-emission legal kits.

CTO Valve vacuum connections



HOWELL Vacuum Schematic



- Connect the purge signal to the dual CTO valve on the engine. Tee the purge line into the
- PCV line, which gets full time vacuum at port C on the TBI unit. (3/8" diameter port)
- Fuel tank vent line is already in place.
- The final, or carburetor bowl vent line on canister must be plugged or capped.
- The EGR valve gets vacuum from the dual CTO valve.
- The CTO valve gets vacuum from port A on the TBI unit.
- The distributor vacuum is teed into the line from port A to the CTO valve.
- *Some earlier, non-emission models, and non-CA legal kits may perform better with manifold vacuum for distributor vacuum advance.*
- The map sensor gets vacuum from the rear of the TBI unit, port F, and DO NOT tee into this line; it will be installed directly from the TBI unit to the MAP sensor ONLY. (12" max length.
- Any other vacuum requirements must be connected directly to intake manifold, including transfer case vacuum switch, AC controls, brake booster, etc.
- The crankcase vent line from the rear of the rocker cover, will attach to the bottom side of air cleaner for filtered air.

4. OXYGEN SENSOR--At this point, you will want to install the bung (**FIGURE 4**) that mounts the Oxygen sensor if you haven't already done so. **NOTE:** Model years 1981 to 1991, should already have oxygen sensor mounting bung in stock exhaust manifold. Installing the bung can be done without removing the exhaust system. Drill or burn a 7/8" hole approx 3" downstream from the exhaust manifold flange (**FIGURE 5**). The supplied 18MM bung can then be welded into the exhaust pipe. The Oxy sensor can be mounted at any angle, depending on your ability to create the correct hole in the pipe for the bung. **NOTE:** If you do not have in house equipment to make the correct hole in the exhaust pipe and weld in the bung, you may want to have this done at a muffler shop before starting the TBI installation. When the bung is in place, you may install the Oxygen sensor.
5. FUEL LINES AND FUEL PUMP--Before proceeding further in the engine compartment, you should have the fuel pump and filter in place. The fuel pump is an in-line design that will maintain the 12-15 PSI operating pressure at all times. The fuel pump electrical terminals are on the **HIGH PRESSURE (outlet)** end of the pump. Assemble the fuel pump and filter as shown in **FIGURE 6**, using the supplied hose, reducers, and clamps. The fuel filter attaches to the rear main fuel line with about 12 inches of flexible fuel line between cut off fuel line and the fuel filter. The pump should be mounted inside the frame rail above the transmission shield plate or directly to the trans shield plate itself. Use the supplied 1 2" clamp to mount the fuel pump against the frame rail or trans shield, under the vehicle. If your fuel line runs along the passenger side of vehicle you should be able to use one of the existing fuel line clamp holes to mount it. If your fuel line runs along the driver's side of vehicle you could mount it to the trans shield. Measuring on the driver's side of shield 3 3/4" from the front of vehicle to the back, and 3 2" from rocker panel to the center of vehicle you can locate and scribe a mark for drilling a 1/4" hole into shield to mount fuel pump clamp and pump. The fuel filter will have adequate support from the connecting hoses, so it does not need to be clamped down. **NOTE: IT IS NECESSARY TO FILTER THE FUEL BEFORE THE PUMP TO PROTECT IT FROM FOREIGN MATTER. HIGH PRESSURE PUMPS ARE EASILY SEIZED, AND WE DO NOT WARRANTY AGAINST THIS FAILURE. IT IS ALSO NECESSARY TO MOUNT THE FUEL PUMP AT OR BELOW MID-LEVEL OF THE FUEL TANK; THAT IS, IF YOU ARE LOCATING THE PUMP IN AN OTHER THAN RECOMMENDED AREA.** Using the supplied 5/16" fuel hose, run your high pressure fuel line from the fuel pump to driver's side fitting on the back of the TBI unit. Route the fuel line carefully, away from sharp edges and the exhaust system, and secure it with some of the supplied tie-wraps and mounts. If you prefer, you can fabricate a 5/16" steel line for your high-

pressure fuel, but it must connect to the fuel pump with a short length of rubber line to prevent noise transfer from the pump. Since the TBI system operates on only 12-PSI fuel pressure, it is not necessary to have high-pressure hose, or aircraft type threaded connections. Your bypass return fuel line is either 1/4" or 5/16" hose and routed from the right rear of the TBI along the left side firewall to the vicinity of the vapor and fuel vent steel lines. Connect the bypass return to the line formerly used to return vapor from the Jeep fuel filter to the tank. Install hose clamps at all connections, both pressure and return, and tighten (Do not over torque clamps, as this will destroy hose, and will not improve the seal).

6. JEEP THROTTLE LINKAGE attaches to the ball stud on the throttle lever plate (**FIGURE 7**). There is sufficient torsion return spring on the 2-barrel TBI units, so you should not need a separate return spring. Check for wide-open throttle and bend the vertical linkage if necessary to clear the EGR valve to achieve WOT. Some later model Jeeps will require the throttle ball stud to be installed inward, on the throttle plate. **The throttle link plate may need to be slightly ground on one edge to clear the vacuum fitting on the intake manifold** or, remove power brake fitting from intake, and mount a new fitting in place of the longer fitting to give adequate clearance to the throttle linkage plate for full throttle movement.
7. AIR CLEANER--GM makes an excellent 10" open element air cleaner that fits the TBI properly and clears everything. It is available under Part #12342081 or #12342082 (**FIGURE 8**). K&N makes an excellent 9" open element air cleaner, under K&N part numbers (#60-1120 and #60-1110), --also K&N (7" diameter, 2" high #60-1320) and (7" diameter, 3" high #60-1330). Moroso has an 8 1/2" #66-310.

INSTALLATION OF ELECTRONIC COMPONENTS AND WIRING HARNESS

The Howell HP/TBI Wiring harness supplied with your system does all the interconnecting wiring from the engine sensors and TBI unit to the GM vehicle ECM. It is designed to fit your Jeep with a minimum of left over wire when properly installed (CJ and Wrangler harnesses are different in comparison). The ECM, fuse block and diagnostic connector will be located under the dash. If you happen to have the OEM California emissions model Jeep, the MCU could be located in the engine compartment, near the front driver's side area. **NOTE: THIS SECTION OF INSTALLATION WILL NOT APPLY TO THOSE JEEPS THAT DO NOT HAVE COMPUTER CONTROLLED CARBS. THE DURA-SPARK IGNITION ON NON-COMPUTER CONTROLLED CARB SYSTEMS ARE ALREADY WIRED DIRECTLY FROM THE DISTRIBUTOR TO THE MODULE.** Skip to (72-81) On models equipped with computer-controlled carburetors, proceed as follows. Remove far right instrument cluster bezel; 3 screws along the top and 4 along the bottom of glove box door. Remove middle instrument cluster bezel; 3 screws along the top and 3 along top of stereo and heater controls. If equipped with A/C remove 4 screws under the dash along the A/C vent duct and gently lower the duct away from dash. Remove stereo away from dash also. Remove the four, glove box mounting screws that are located on the back of the outer glove box ears, and remove glove box. Remove computer mounting screw and bracket. Remove the 2 nuts located on the engine side of the firewall near the battery to pull computer out for access to the harness connector bolt of the computer. Remove harness connector to allow computer to be removed from the dash. To remove harness from vehicle, the defroster duct must be removed to prevent damage and allow for easy removal through firewall. The rubber grommet will be pushed through firewall with a screwdriver, and then cut through on one side to be reused on the new harness. Once harness is removed from within the vehicle, lay the connector over the intake to begin eliminating excess wiring. Three wires will remain, along with the manifold heater relay wiring, from main harness on firewall; the temperature-sending unit (purple), which is located on the left, rear side of the valve cover. The manifold heater (pink) and manifold heater switch (light green-black) located on intake, below and behind carburetor opening. Remove main harness away from firewall by unfastening mounting clips, and strip covering back to expose wiring

at the computer harness and main harness junction. Refer to page 12 for a diagram showing the complete wire-up for the Jeep Dura- Spark Ignition System. Some earlier models Jeeps do not have the numbered computer connector, the same color codes, or Dura-Spark Module Connector. Located on the back of the computer harness connector are the wire location numbers. To reveal connector number locations, remove the black retainer clip from the back of the computer connector. Number 47 (light green/black or orange on some models) will be cut and spliced into 59 (orange) at or near the junction in the main harness. Number 18 (purple) will be cut and spliced into the ignition module jumper wire supplied in kit. Some models require a direct splice or connection at module connector (purple wire). For models 87-91 use the procedure in the next four lines as described.

To install jumper wire, remove the two (2 and 4 pin) connectors from the ignition module located under coolant bottle and raise connectors and harness to locate 4-pin connector. Release connector lock and install jumper wire in the open or "C" position of the four-pin connector. Close lock and feed jumper wire through harness to junction and splice into 18 (purple). Re-connect 2 and 4 pin connectors to Dura-spark module. **NOTE: MAINTAINING WIRES NUMBERED A1" OR A57"(YELLOW) WILL GIVE THE OPTION OF USING ONE OF THESE WIRES AS YOUR SWITCHED 12 VOLT POWER SOURCE.** The remaining wires from computer harness connector will not be used and they will be cut at the main harness trunk and removed. To maintain manifold heater, trace the blue wire from manifold relay, located to the right of the battery, and apply switched 12 volts (hot with ignition on) for proper operation. Another method would be to run direct power to the heater using a switch to operate it manually. The remaining relays and diagnostic connector can either be removed or kept in place. Replace the covering of the main harness and attach to clips on firewall. Remove Coolant Temperature Switch, Knock sensor and Oxygen sensor. Install new Coolant sensor in Coolant Temp switch mounting hole and new Oxygen sensor into the exhaust manifold. Leave the Dual CTO valve in place. Knock sensor mount hole will remain open.

(72-81) For models without computer controlled carburetors there is room to mount the ECM in a vacant space above the heater ducts. For 1972-80 models you will need a 1-1/2" hole in the firewall (**FIGURE 9**). This can be done with a hole saw or Greenlee sheet metal punch. The harness can be fed through this hole from inside the Jeep. A rubber grommet is supplied with the kit to seal around the harness and hole in the firewall. In models that have computer controlled carburetors you will use the existing harness grommet and mount the ECM in the same location as the OEM ECU was mounted, using either Velcro or existing brackets.

1. The harness grounds attach to an existing threaded hole towards the rear of the intake manifold (**FIGURE 10**), and locate the harness position at the back of the engine. The engine trunk portion moves forward between the rocker cover and TBI from that point.
2. After the grounds are secured, route the labeled purple and orange wires to the starter solenoid on the right hand fender well or to the starter. These wires each have a lug that attaches to the stud on either side of the solenoid or starter. (**FIGURE 11**) The orange wire is battery power and connects on the battery side of the solenoid or the positive post of the starter. The purple wire connects on the opposite side of the solenoid or to the starter solenoid post of the starter. Connect the labeled white wire to the ignition coil negative terminal to pick up a tach Signal.

NOTE: Multiple spark discharge ignitions require a special Tach filter to function correctly.

Contact Howell Engine Developments if you need one. The Oxygen sensor wire should be long enough to attach to your previously mounted Oxygen sensor. If necessary to extend it, cut and solder splice on the harness side, not the Oxy sensor lead wire.

3. Moving forward, connect the 2-injector connectors at the top of the TBI and plug in the throttle position sensor and idle air control motor. The MAP sensor connector branches out of the harness near the grounds, and connects to your MAP sensor. The MAP sensor can be mounted in any convenient location on the firewall; however, it should be mounted WITH THE

VACUUM LINE POINTING DOWN, and level with, or higher than, the TBI base (**FIGURE 12**). The MAP sensor has its own vacuum tap at right rear of the TBI, and NOTHING should be tee'd into this line.

4. The coolant sensor is mounted using in an existing 3/8" NPT threaded hole on the left side of the engine which may have previously mounted a temperature controlled vacuum switch (**FIGURE 13**). Models with water heated intake manifolds have a suitable hole for the new coolant sensor. Use Loctite or equivalent, pipe sealer on the sensor. Connect the harness to the coolant sensor. This completes the connections on the engine.
5. Toward the passenger side of the firewall, a separate branch tees off the main trunk, and contains the fuel pump relay, battery power and fuel pump power fuses. These can be permanently attached to the engine firewall on the right side (**FIGURE 9**). Also near this point of the harness, the fuel pump power lead breaks out, and can be routed to the fuel pump, and connected with a two-pin Weatherpack connector. This lead contains power and ground for the frame mounted fuel pump. The VSS is adapted to the transfer case speedometer cable drive output. To install, remove the speedometer cable and thread VSS in series of the transfer case and speedometer cable and attach VSS connector to harness.
6. **INSIDE THE VEHICLE**--Mount the fuse block and diagnostic connector, along the bottom of the dash or on the heater housing. **CAUTION:** The ECM needs some air circulation for cooling; so don't put it under the carpet. Use a Radio shack or automotive bulb socket and 12V bulb for the SES (check engine) light, and mount it in the dash.
7. Using one of the single weatherpack connectors and terminals supplied, and 16 or 14-gauge wire, connect the ECM fuse block to a 12V source that has current when your ignition key is in **BOTH THE CRANK AND RUN** positions. (Not an accessory position, which loses power during cranking). This completes the electrical harness installation.

CAUTION: CHECKING FOR FULL SYSTEM VOLTAGE- it is not unusual for older Jeeps to experience a battery voltage drop passing through the firewall to fuse block area. THE GM TBI SYSTEM MUST HAVE FULL BATTERY VOLTAGE TO OPERATE PROPERLY. Check your voltage to the ECM and compare it with your battery voltage at the battery. If it is more than 1 VOLT less than battery voltage, you will need to correct voltage loss. If this is not possible, run a separate battery power source to the triple fuse block through an ignition controlled relay, or toggle switch on the dash. Low system voltage will result in hard starts and poor idle problems.

CALIBRATION PROM AND VEHICLE ECM

The brain and control center of your new electronic fuel injection is the Electronic Control Module (ECM). It controls the amount of fuel delivered at any time, based on inputs from the Oxygen sensor, coolant sensor, MAP sensor, and throttle position sensor. The correct fuel settings are pre-programmed into the calibration prom, and match your engine closely, for everything to work correctly.

The JP-1 prom is the only emission legal prom for California Jeeps. The calibration prom and a smaller removable chip called a Cal pack, are pre-installed in your ECM. The Cal pack contains back-up or limp-home programs in case one or more sensors fail, and the ECM cannot do its proper function. This will keep you from being stranded in event of sensor failure, until you can

get the trouble corrected. The Service Engine soon light will come on anytime any back-up features are activated.

Your vehicle ECM is GM part number 1227747. This is the ECM used in most light duty truck TBI engines from 1987 through 1991. If replacement is necessary, it is available at any GM dealership. It is a rugged, proven design, the result of millions of GM dollars spent on development. It has the ability, operating in closed loop, to learn a calibration that perfectly matches your engine, and retain it in memory. An added benefit of the GM ECM is its ability to alert you to a potential sensor or electrical problem by turning on the "SERVICE ENGINE SOON" light, built into your harness. This light and a common paper clip will allow you to discover and diagnose any problems retained in the ECM memory. Procedures for this are outlined in any GM TBI service manual, or the Howell HP/TBI service manual that accompanies your TBI kit.

The CALIBRATION PROM supplied with your kit is mounted inside the ECM, under a plate retained by two screws. There is only one emission legal prom for California Jeeps. In the event you need to replace it, follow the instructions below:

1. Remove the ECM from its mounted location. Depress the latches and remove the harness ECM connectors, one at a time, from the ECM.
2. Remove the ECM cover (retained by two screws).
3. Remove the larger of the two cal proms by carefully prying and lifting it straight up.
4. Install the replacement cal prom. (It will only go in one way, so it can't be installed wrong.) Replace the cover.
5. Reverse the removal sequence, and reinstall the ECM in its vehicle mounting location.

CAUTION!! Do not remove the cal prom with harness still connected to the ECM. It may be damaged by 12v power that is always present in the vehicle harness when the battery is connected.

INITIAL VEHICLE START-UP AND OPERATION

With everything mounted and connected, the vehicle should be ready for start-up. When ignition key is first turned on, listen for fuel pump operation. It should turn on for 2 or 3 seconds, and then the ECM will turn it off until you engage the starter. The first time ignition is turned on it may not be sufficient to fill the TBI and fuel line with fuel. Cranking for a few seconds should complete the filling. The engine should start up and smooth out after a few seconds to purge air from the injectors. Check for fuel leaks, and make sure none of your altered wiring or fuel lines are in a position where the exhaust system heat can damage them. **MAKE SURE THE COOLING SYSTEM IS FULL.**

If the engine does not start immediately, it may be because the fuel pump cannot displace the air in the line and prime itself. Loosen the high-pressure line at TBI, and cycle the pump by turning on the ignition key to displace the air. Wrap a rag around the fitting to prevent gas from spraying around the engine compartment.

Look at your "SERVICE ENGINE SOON" light when attempting to start for the first time. The light should come on when the ignition is turned on, stay on during cranking, and go off when the engine starts.

IF THE LIGHT GOES OFF DURING CRANKING, IT MEANS YOU HAVE POWERED THE ECM AND INJECTORS FROM AN ACCESSORY FUSE BLOCK TERMINAL, AND THE ENGINE WILL NOT START. Your switched 12v power must come from a terminal that is hot with key on, and during cranking, and goes off when the ignition is turned off.

INITIAL DRIVING IMPRESSIONS

The calibration prom supplied with a CARB EO approved JP-1 kit is specifically designed to operate your Jeep in an emission legal mode using the following emission components and settings: EGR operating by ported vacuum through the Dual CTO valve, ported vacuum to the Jeep distributor set at 6-8 degrees BTDC initial timing at idle, and a catalytic converter in good condition. Proms for other kits are similar but may not be exactly the same. This prom should be a near perfect match for your engine. However, the GM ECM has the ability to learn, and adapt a new program to match your engine. It does this by reading information from the Oxygen sensor and adjusting the calibration until it matches GMs original intent. It will adjust this new program as weather, barometer, and altitude change, and store it memory as long as the battery is connected and charged. If you disconnect the battery, the ECM will lose the learned program and revert back to the original Howell JP-1 program. However, it will immediately start learning again as soon as you start driving the vehicle.

Any electronic or engine control problems can be diagnosed by a GM dealer or tune-up shop, using their computer diagnostic scanner that plugs into the ALDL or diagnostic connector near the ECM. (When diagnosing with a scanner, enter the engine as an 88 or 89 GM light duty truck application. The 4.3 V-6 engine code is Z). When using other types of scan tool equipment you may use the third digit as C , the eighth digit as Z and the tenth digit as J or K. Our service manual also gives techniques for do-it-yourself diagnostics using a jumper, the ALDL connector, and "SERVICE ENGINE SOON" light.

SERVICE NOTES

1. Don't forget to install the new under hood decal showing the vacuum line schematic and CARB OE number and information, included with JP-1 kits.
2. Unless otherwise stated below, follow Jeep OEM recommended service maintenance procedures and intervals.
3. The kit assumes you have an engine in mechanically good shape, no vacuum leaks at the intake manifold, and no leaks at the exhaust manifold.
4. There are no idle speed or air fuel ratio adjustments on the Howell EFI kits. Only initial spark timing is adjustable. Our recommended setting for good emissions and drive ability is 6-8 degrees BTDC, at idle with vacuum advance disconnected. This setting is higher than the original OEM recommendation.
5. AFTERMARKET IGNITION SYSTEMS: If you are running an aftermarket ignition system (MSD, Mallory, Jacobs, etc.), you might not have a coil signal that will trigger our built-in tach filter. If your engine will not start, and you have one of these systems, contact Howell Engine Developments at Ph 810-765-5100 for assistance.

TROUBLE SHOOTING PROBLEM DESCRIPTION & SOLUTIONS

SYMPTOM: Engine cranks but won't fire or start.

- Check: To see if there is spark while cranking. This can be done with an inductive timing light or with a spark plug connected to a plug wire, grounded against any metal surface on the engine. If there is spark, go on to the next check. If not, fix.
- Check: Observe to see if service engine soon light comes on when ignition key is turned on. If not, harness may not be powered up or grounded correctly. Check grounds, fuses, and power with a voltmeter or test light. If powered up and grounded correctly, SES light should come on, and fuel pump activated for 3 seconds.
- Check: Observe A service engine soon light while cranking. If it goes off during cranking, you are connected to an accessory terminal on the Jeep fuse block. Correct by running switched 12V wire to an ignition power source.
- Check: Observe, or have someone under vehicle verify whether fuel pump comes back on while cranking engine. If not, you are not getting a tach reference from your tach lead connected to the coil negative, and the ECM doesn't know the engine is cranking. (See service note #5 above on aftermarket ignitions). If pump is activated while cranking, go to the next check step.
- Check: With air cleaner removed, observe TBI injectors to verify if any fuel is being sprayed while cranking. If not, the fuel pump may not be primed. Loosen the high-pressure line (on drivers side of TBI), wrap a shop rag around it and activate the fuel pump by turning on the ignition key. When fuel comes out, re-tighten clamp and try again to start engine. If fuel spray is minimum, tee into high-pressure line and check fuel pressure. It should be 11-12 PSI. If no fuel comes out, you may have a low voltage problem. Using a voltmeter, check from JP-1 fuse block near ECM to ground, while cranking. Compare with voltage across battery terminals while cranking. They should be within 1 volt of each other. If greater than 1 volt, temporarily run a hot wire from ECM fuse block to battery and see if engine will start. If so, fix low voltage problem to ECM fuse block.
- Check: With air cleaner removed, observe injectors to see if too much fuel is being sprayed. If so, hold accelerator fully open and crank. This is called clear flood mode and injectors should cease to spray so that excess fuel can be cleared, and the flooded engine started. This condition can be caused if your bypass returns fuel line is restricted or plugged. Temporarily correct for this by attaching a length of hose to the bypass return outlet of the TBI and running it to a 5-gallon can. If engine starts and runs with proper fuel, correct problem with restricted bypass return. (Bypass return pressure should not exceed 5-6 PSI).

SYMPTOM: Engine starts but runs poorly at idle or dies.

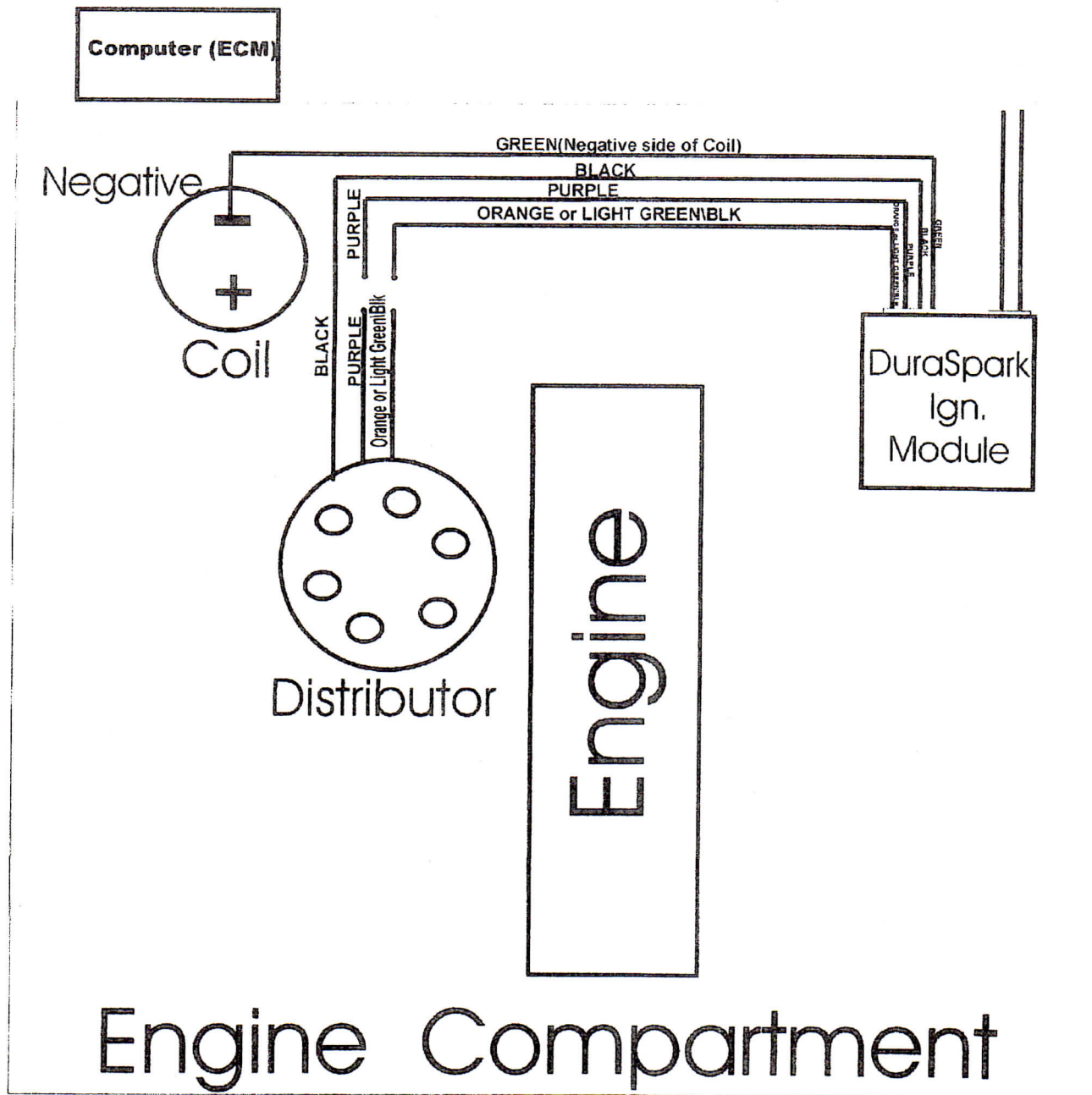
- Check: System voltage at ECM fuse block. Must be within .5V of battery voltage while running. Possibly poor connection through Jeep firewall to Jeep fuse block, or inadequate wiring to ECM fuse block. Temporarily run bypass 14 gage wire from battery to ECM fuse block to see if that improves running. If so, supply ECM fuses power from battery through an ignition-controlled relay.
- Check: For possible rich condition and black smoke at idle and low speeds. Test for excess bypass return pressure causing TBI fuel pressure above 12 PSI.
- Check: If you are having problems with decel off-idle stall and idle drop or low rolling idle, refer to Idle Air Adjustment Instructions.

Idle Air Adjustment Instructions

Before beginning adjustment, grind the throttle stop screw plug, flat and drill into the plug to allow a T-20 Torx driver to access the screw.

1. Jumper A and B terminal of the ALDL connector.
2. Turn ignition key on-engine off.
3. Disconnect 4-pin idle air control connector from the TBI unit.
4. Remove jumper from ALDL connector.
5. Start engine.
6. While idling, adjust throttle stop screw to increase base idle rpm as desired.
7. Turn engine off.
8. Reconnect idle air control connector.
9. This will complete the adjustment.

Ignition wiring circuit for 1981-91 Jeeps with Duraspark Ignition as modified for use with Howell EFI.



NOTE: If none of the above troubleshooting resolves your problems, contact Howell Engine Developments, Inc. Phone 810-765-5100 or FAX 810-765-1503, or email our web site at (mhowell@howell-efi.com).

WARRANTY

Howell Engine Developments, Inc. products have a 30-day unconditional guarantee. The product can be returned within 30 days from shipping for a 100% refund (less shipping charges) provided that it is returned post paid, without damage or modification, and has not been installed.

The CARB/EPA exemption granted to the JP-1 kit mandates that no modifications can be made to its components, no reprogramming of its computer, and no deviations is made from this instruction manual without consent from Howell Engine Developments, Inc. and/or CARB/EPA as required. Howell Engine Developments, Inc. assumes no responsibility for the function or suitability to task of any modified kits.

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Any damages that may have occurred during shipping should be reported immediately to the shipper and not Howell Engine Developments, Inc. Howell Engine Developments, Inc. is not responsible for any damages to equipment and possible liability injury that could result from improper use of the product. Howell Engine Development's maximum total liability under any conditions is the repair or replacement of the product.

PRODUCT RETURN POLICY

Most products can be returned for credit within 30 days of shipping. All returns must be as new for maximum credit and free of modification and scratches. A 15% restocking charge will apply to any used returned components in good condition, and a 25% charge will apply to all components requiring repairs or unusable as returned. All return shipping must be prepaid.

TECHNICAL ASSISTANCE

Technical assistance over the telephone can be obtained from Howell Engine Developments, Inc. at 810-765-5100 between the hours of 8:30AM and 6:00PM Eastern Standard Time (or Daylight Savings Time in summer months).