

HOWELL

ENGINE DEVELOPMENTS, INC
FUEL INJECTION APPLICATIONS

INSTALLATION MANUAL

LS-1 & GEN III/VORTEC TRUCK EFI WIRING HARNESSES

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INSTALLATION INSTRUCTIONS LS-1 AND GEN III (VORTEC) TRUCK EFI WIRING HARNESSSES

You have just acquired our premier engine/transmission wiring harnesses, enabling you to install and wire up a late model LS-1 Camaro/Firebird or 1999 & later Generation III (Vortec) small block truck engine. LS-1 and Gen III V-8 engines are similar in many respects, using separate sequentially fired fuel injectors and 8 separate ignition coils mounted above the rocker arm covers. They are distributor-less and the vehicle computer (PCM) receives a camshaft and crankshaft signal to time and distribute fuel and spark.

Corvette engines, and many of the later model Escalade and Trailblazer engines have electronically operated throttles (drive-by-wire) and this must be replaced with Camaro or truck throttle bodies to allow for cable or mechanical operation. Other differences exist in the Mass Air Flow (MAF) sensors and PCM's used for different model years (97-98 engines use a different PCM than 99-2005 engines). All transplants must use a PCM with a modified calibration to eliminate the Vehicle Anti-Theft System programmed into the factory version. Some of these special calibrations are available from GM through their special parts organization. Howell Engine Developments, Inc. CAN SUPPLY modified PCM's to match and compliment your application, as well as by-pass the VATS and eliminate nuisance trouble codes. In all cases, you **MUST HAVE A MODIFIED PCM TO OPERATE THESE ENGINES.**

Howell Engine Developments, Inc. also manufactures and supplies special harnesses for late model stock car racing and matching PCMs to run these modified engines. This is an open loop calibration using various injector flow rates, (24 lb/hr is stock) running increased overlap camshafts with 1200 RPM idle and the truck MAF with integrated intake air temp sensor. (Any 99 to 2005 calibration can be changed to run the more economical Truck MAF if desired). These PCM calibrations are not suitable for stock LS-1 engines.

The basic Howell LS-1 harness is a street rod type, stand alone design, available with or without wiring for the electronic transmission and including all emission connectors so that it is **LEGAL** in 50 states as a replacement harness.

If you are salvaging a late model wreck for the engine you will use, try to get the PCM, complete air cleaner (with MAF in the inlet duct) and as much of the exhaust system as you can use in your new application. (Gen III truck engines use 4 Oxygen sensors in the exhaust, 2 ahead and 2 behind the catalytic converters.)

INSTALLATION

Gen III harnesses are designed so the PCM, fuse block and relays mount under hood. A factory PCM mounting bracket can usually be adapted to your vehicle. The diagnostic connector can be routed through the firewall for access inside the vehicle. The "Service Engine Soon" light is integrated with the diagnostic connector.

In the engine compartment, the main branch of the engine harness goes down the driver's side with the main grounds attaching to the back of the LH cylinder head. This locates the harness on the engine. All connectors are labeled and will normally reach and attach only to their intended sensor. The camshaft and MAP sensors are at the back of the engine and the crank sensor is above the starter on the right hand side of the block at the rear. (Racing harnesses have a different layout with the main trunk on the right side of the engine.) 2005 LS-2 engines have relocated the cam sensor, and map sensor to the front of the engine, and use difference knock sensors located on either side of the engine.

POWER AND IGNITION CONNECTION – basic power for the cooling **FANS** is supplied through a ring terminal connecting the harness to the alternator post. The two wires that power up the **HARNESS** come out of the fuse block. The Orange wire connects to a convenient source of full-time **BATTERY** power.

The pink is the switched 12V **IGNITION** power that is hot with switch on and during cranking. If you need to extend any of these wires, be sure to use wire of similar gauge to prevent any reduced power to the engine components. **NOTE:** If installing one of these engines in an older vehicle be sure your ignition switch is wired correctly to provide the power leads described above.

MISCELLANEOUS WIRING – Several additional wire leads are provided coming from the main harness trunk that will power up and ground your electric fuel pump, operate air conditioning and operate dash gauges. They are all labeled and may be used or ignored, as you need in your installation. All of the original factory wire colors have been retained in these harnesses, so you can trouble shoot problems using the factory service manuals should it ever be necessary.

FUSE BLOCK – A 4 cavity fuse block is built into each harness. The fuses protect the engine circuits as follows:

1. 20 Amp fuse providing battery power for the PCM and the ALDL.
2. 15 Amp fuse providing switched 12 V to the injectors and ignition coils.
3. 10 Amp fuse providing power to Oxygen sensors, TCC lockup and the A/C compressor
4. 10 Amp fuse powering Transmission connector, MAF, Ck Engine lite, and the A/C and fan relays when applicable.

This fuse block should be protected from the weather, either under hood or inside the vehicle.

FUEL PUMP INSTRUCTIONS – The LS-1 and Gen III engines run on 58 PSI fuel pressure. On all Gen III engines and the 1997 Corvette, the fuel pressure is regulated at the engine and requires a fuel return line running from the engine back to the fuel tank. 1998 and later LS-1's and LS-2's using an in-line or in-tank pump, must be equipped with a separate **BYPASS** type fuel pressure regulator, mounted near the gas tank, with a return line dumping back into the tank. 58 PSI regulators, combined with a fuel filter are used on Corvette and other GM cars, and are available from Howell Engine Developments, Inc. with either AN or hose nipple fittings.

There are several sources for high-pressure fuel pumps. The Corvette, Camaro and Trans-Am use excellent in-tank pumps made by AC products. We stock and sell Air-tex manufactured in-line fuel pumps with hose nipple ends and Bosch sells in-line pumps for most foreign and some domestic EFI vehicles. Mount the pump and regulator under the floor near the fuel tank and rubber isolate it with mounts and flexible fuel lines or it will be noisy. Unregulated pumps typically will supply 80-90 PSI, which regulates easily to the required 58 PSI for your system.

AIR CLEANER – Depending on your installation or what you salvaged from the scrap yard with your engine, you may run the original vehicle air cleaner or a cleaner of your choice. With a Mass Air Flow Sensor you can put a right angle duct in front of the throttle body and install the airflow sensor perpendicular to the engine. Always operate your engine with an air filter attached to the open end of a MAF sensor. Air blowing across the open end will seriously affect engine operation. Do not locate a MAF more than 12 to 14 inches from the throttle body or it may affect the calibration. Do not mix MAF sensors between LS-1 and Gen III truck engines. Corvettes & Camaro LS-1's use an aluminum body MAF with separate Intake Air Temp sensor located in the air duct. Gen III trucks use a plastic bodied MAF with integral IAT. The truck MAF's will flow slightly more air, and are more economical to purchase, but require a different calibration to match them to an engine. Howell Engine Developments can reprogram your LS-1 PCM to allow use of the truck MAF.

OXYGEN SENSORS – Because these engines operate with a stock PCM, you must run the factory specified 2 or 4 heated Oxygen sensors (LS-1's use 2, Gen III truck use 4). The 2 front ones are mounted close to the engine and on the trucks, the 2 rears are behind the catalytic converters (or just further downstream if you don't have catalyts). The Oxygen sensors are available from Howell Engine

Developments if you don't have the originals. We also can supply 18mm nipples to weld into your exhaust to mount the Oxygen sensors, if you need them. Our experience is that the engines run code free with all sensor operating.

The GM PCM's are "smart" computers and will improve their driving calibration while operating in closed loop and retain it as long as the battery power remains connected. Normally the engine will go closed loop after the oxygen sensor reaches 600 degrees F. Whenever the battery power feed is disconnected the PCM will lose its stored memory and may not drive as well for a while until the learned calibration is restored, by driving. **NOTE:** In the rare case that Oxygen sensor connectors get reversed from side to side, your vehicle will drive OK with a clean memory PCM until it goes into closed loop. In closed loop, it will get confused signals because each bank of the engine is controlled separately and then will start to run terrible. If you have these symptoms, look for reversed Oxy sensor leads.

START UP AND INITIAL DRIVING

With all the previously discussed connections made and 58 PSI of fuel pressure, your vehicle should start right up and smooth out as soon as the air is purged from the injector nozzles. Check for fuel leaks and make sure none of your 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 air in the line and prime itself. Loosen the high-pressure line at the engine 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 you "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 PCM 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, during cranking and goes off when the ignition is turned off.

If your engine starts but runs only a few seconds and then stops you probably have a stock PCM with Vehicle Anti-Theft operating. You will need a reprogrammed PCM to operate the engine. As mentioned previously, Howell Engine Developments can supply these or reprogram your present PCM.

Because our wiring harnesses keep all essential engine functions operating they qualify as direct factory replacements for emission function in the eyes of the EPA and CARB. Contact us if you need additional help with your installation. For older vehicles (without brake interrupt TCC wiring) we can supply lock-up kits using a vacuum switch and 4th gear pressure switch to work on all transmissions with lock-up converters (THM 350'sm 200 R4's and 700 R4's). We can also supply the required Vehicle Speed Sensor (for cable driven speedometer outlets) for the LS-1/GenIII installation with manual transmission or non-electronic automatics.

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