

LS Engine Installation Guide

www.BluePrintEngines.com

Congratulations!

Congratulations on your purchase of a BluePrint Engines LS series crate engine. We sincerely thank you for your purchase and are excited to welcome you to the BluePrint Engines family. Whether you're cruising, heading to the racetrack, or navigating your favorite off-road trail, your BluePrint Engine is built for maximum performance and enjoyment at every turn. Inside this installation guide you'll find the information and direction you need for proper engine installation, break-in, and maintenance. Follow these instructions to ensure years of trouble-free performance and driving pleasure. If at any point you need additional assistance after fully reading this guide, please reach out to us via phone, our website links, or email. We look forward to helping!

This installation guide is meant to be used for general information on components and procedures for installing your new BluePrint Engines LS series. It is not intended to be an all-inclusive guide and if at any time you have questions, please reach out to our tech department at **308-236-1050** and they will be happy to help. Please read through the entire guide before starting your install to make sure you have all necessary components and parts. The guide is broken down into two main sections.

The first installation guide section is general LS engine install information, mainly intended for retrofit swaps into vehicles that were not factory equipped with an LS engine. It does however contain useful information for ALL LS installations, so please review even if replacing an existing LS engine.

The second is for vehicles that came from the factory with an LS engine. Please see page 3 for existing LS application.

Important information online:

Important details pertaining to your new high-performance BluePrint Engine are located online at www.BluePrintEngines.com. Use the search bar to enter your engine's part number and view details about what's included with your engine, a list of recommended add-on parts, and engine specifications.

For front accessory drives, transmissions, and other non-vehicle specific equipment, see your engine's product page at www.BluePrintEngines.com.

Octane requirement (example: 91 octane for BluePrint LS engines) will also be noted online.



INSTALLATION PROCESS AT-A-GLANCE

An LS swap into an older muscle car or truck will require a great deal of supporting bolt-on equipment and custom components that are MUCH different than a traditional SBC or BBC engine. Things to consider and fully understand, include, but are not limited to modification or changes to your existing exhaust, engine mounts, transmission, transmission mounts, and fuel system upgrades. This publication is not designed to be an all-inclusive guide to installing LS engines in non-LS applications as there are many vehicle-specific differences and many aftermarket resources for headers, motor and transmission mounts, and other supporting equipment.

- 1 Review this installation guide carefully before beginning installation.
- 2 Use our search bar feature, and enter your engine's part number to find the list of recommended add-on parts, as well as specifications for your engine.
- 3 Remove your engine from its crate and check for:
 - a. Possible damage during shipping.
 - b. All parts that were ordered with your engine.
- 4 Read and follow all TAGS attached to your engine. These are extremely important and include things like fluid capacities and types.
- 5 Prepare a complete list of add-ons that you will need to complete your engine installation, including new and existing parts. Refer to add-on recommendations for your engine at www.BluePrintEngines.com.
- 6 Do not assume everything from your old engine is identical to the new one. **This is ESPECIALLY TRUE of LS retrofit swaps.**
- 7 Determine what you need to finish your installation in your application. This could include items such as:
 - a. Headers
 - b. Engine mounts, transmission mounts, etc.
 - c. Adapters for sensors, transmissions, etc.

See pages 4-6 for some common swap parts and tips.
- 8 Install engine in engine bay and plumb/wire in fuel, ignition, ECM, TCM (if using 4L60E, 4L80E), etc.
- 9 If your engine was purchased and shipped with a BluePrint Engines ECU/Harness package, it has been loaded with a start-up tune for your engine. Some vehicles may operate fine with the included calibration, but many will require additional tuning once installed in your vehicle as tire size, vehicle weight, gearing, transmission type, etc., will all affect drivability. Any concerns dealing with drivability, or driveline damage, without being tuned by a professional, are not covered by BluePrint Engines warranty.
- 10 An electronic version of the crate engine controller instructions that should have also been provided with your engine can be found here: <https://blueprintengines.com/pages/tech-tips> and click on "LS Controller PDF" at the bottom of the page.
- 11 If your engine came from BluePrint Engines equipped with an automatic transmission, the MSD Atomic controller instructions should have been included with your package, or an electronic copy is available here: <https://blueprintengines.com/pages/tech-tips> and click on the "MSD Transmission controller PDF tab.
- 12 We highly recommend that you consult a chassis dyno shop with LS tuning software such as HP tuners, or GM Livewire once the engine is installed. The ECU is not locked so that professional tuners can adjust as needed. Again, all LS retro swapped engines or engine packages are subject to probable tuning by a professional for your application. If your engine comes with an ECM from BluePrint, the tune is to be considered a start-up tune and is meant to get the engine running.

! Professional tuning is required to maintain engine warranty!

HOW TO PREVENT ENGINE FAILURE!

WHY ENGINES FAIL	BEST WAYS TO PREVENT FAILURE
Bearing failure due to improper pre-lubrication.	Follow pre-lubrication procedure to ensure engine is primed and ready to fire. See Step 2 on Page 4.
Improper tune, or no tune.	It's extremely important to note that LS engines require professional level tuning. Engines shipped without an ECU require professional level re-tuning of your factory ECU. Engines shipped with an ECU will still require professional chassis dyno level fine tuning for optimal performance.
Overheating.	Always install a new thermostat with a bypass hole for your engine.
Leaking gaskets due to inadequate torque, or loosening during heat cycles.	Always retorque manifold bolts after a heat cycle to ensure proper seal. If using aftermarket headers, contact the manufacturer for proper gaskets. Recheck intake, front accessory, and water pump bolts to ensure nothing has loosened from heat cycling.
Poorly cleaned add-on parts that result in premature failure.	Clean all add-on parts professionally to prevent abrasives from getting in oil. Never use abrasive sanding discs or blasting media to clean parts.

LS Engine Installation

INSTALLING OUR LS ENGINES INTO A VEHICLE ORIGINALLY EQUIPPED WITH AN LS

The following information should be read, and understood, if you're replacing an existing LS engine, or your vehicle came equipped with a factory LS engine. Although all LS engines are similar, please be aware that BluePrint Engines manufactures engines with both 58X and 24X configured reluctor wheels. You can install a 58X engine into a vehicle originally equipped with a 24X engine with some accommodations, but you cannot install a 24X into a 58X vehicle.

You will also have to note and research the following:

- LS front accessory drive spacing variations
 - Corvette (most BPE engines)
 - F body truck
 - Truck
 - Late Camaro
- General gen III vs. gen IV LS engine series
- 24X vs. 58X Reluctor wheels
- Possible 58X to 24X signal converter
- Cam sensor location, and window
- Throttle body differences and adapters
- General sensor locations
 - Knock
 - Cam
 - Oil pressure
- Differences in intake manifold styles and positions
 - Car configuration
 - Truck configuration
 - Cathedral vs. L92
- ANY of our BluePrint Engines LS engines going into ANY GM vehicle that originally came with an LS may require:
 - VVT and DOD consideration and deletion (BluePrint Engines do NOT have VVT, or DOD)
 - Professional level tuning
 - Wiring extensions / splicing
- ANY of our BluePrint LS Engines going into ANY GM vehicle that originally came with an LS will require:
 - Sensor wire lengthening and position changes
 - Pinout changes on throttle body
 - Intake manifold change or purchase

You may also require:

- Reluctor signal converter throttle body or throttle body adapter

1 GETTING READY FOR YOUR ENGINE INSTALL

- 1 Your engine has been assembled with select parts based on the engine configuration you ordered. Prior to installation, check to be sure your engine arrived with the parts you ordered (base, base dressed, or fully dressed). Now determine the add-on parts you need to complete your installation.
- 2 Add-on parts recommendations and specifications for your engine are available at www.BluePrintEngines.com on your engine's product page. Depending on the engine you ordered, add-on recommendations and related specifications may include the harmonic balancer, flexplate/flywheel, spark plugs, spark plug gap, water pump, etc.
- 3 Certain items like water pump, harmonic balancer, flexplates/flywheels, are much more easily installed prior to the engine being lowered into the vehicle.
- 4 Certain components, like crank pulleys, may be best installed after the engine is lowered into the vehicle for firewall or frame clearance.

! CAUTION: Your engine's assembly lube was washed away during dyno testing. Be sure to PRELUBE YOUR ENGINE before start-up/break-in. Failure to do so WILL VOID YOUR WARRANTY.

2 PRE-LUBRICATION

! IMPORTANT: Engines are shipped without oil and need to be primed before first fire up. We did prime this before running on the dyno, but for warranty purposes, engine needs to be primed using the following instructions. LS engines require pressure priming to prelube the engine. Failure to follow these steps can result in dry fire, bearing failure, and will void the warranty.

- 1 Make sure the engine is level and the appropriate filter and amount of oil are used.

a. Oil filter recommended:

BluePrint Engines (Part# BPPB160)

www.blueprintengines.com/products/gm-gen-iv-ls-oil-filter

b. Oil filter alternatives:

Wix 57060, NAPA 7060, K&N HP1017, Baldwin B160, or AC Delco PF48E.

c. Oil requirements:

Break-in oil is not required. However non-catalytic converter equipped vehicles can run **BPP710 Break-In Oil** for the first 500 miles to promote ring sealing, rocker arm wear-in, etc. **BPP10W30** conventional oil can be used for normal operation. A standard, non-synthetic 10W30 may also be used.

- 2 Fill oil filter with correct break-in oil or conventional 10W30 oil. Reinstall and tighten oil filter.
- 3 **DO NOT USE SYNTHETIC OIL FOR THE FIRST 500 MILES.** Synthetic oil can lead to cross hatch being removed from cylinder walls, leaks, and other issues. Use STANDARD oil, or break-in oil, for the first 500 miles.

- 4 Fill engine crankcase with the appropriate amount of oil for your application.

- 5 Locate and remove the front, left oil galley plug from the engine block. (Fig. 1) *PSLS3760CTF used for reference.

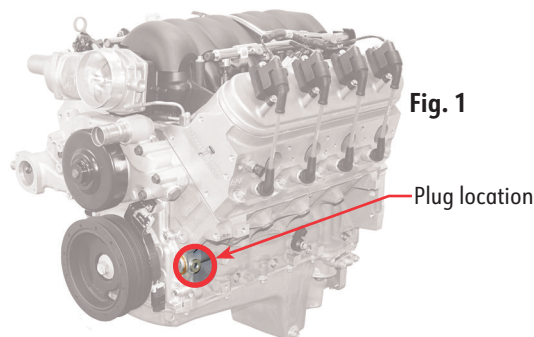


Fig. 1

- 6 Insert 1.5" of a 2' long, 3/8" I.D. fuel hose into the block where you removed the plug.

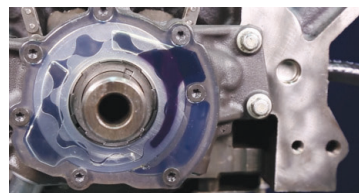


Fig. 2

- 7 Attach a funnel to the other end of the hose and fill with at least 8-10oz of oil slowly, allowing oil to fill the oil pump. Leave hose attached for at least 3 minutes until all oil has filled the pump gears. (See Fig. 2 above for reference)
- 8 Crank engine over without ignition or fuel enabled and verify oil pressure out the port in the top rear of the intake. If you don't have oil pressure, stop and call BluePrint with the serial number.

3 COOLING SYSTEM: Add coolant and install new thermostat

COOLANT:

We recommend you use a quality name brand extended-life coolant. Check the label of the brand you choose to ensure the compatibility of the coolant with your engine metals (cast iron, or cast iron and aluminum) and radiator material. Use a 50/50 mix of antifreeze and distilled water to fill the radiator and engine.

Engine should be filled from the highest spot in the cooling system, be it the water neck, radiator cap, or a remote fill. This helps prevent air pockets from developing in the cooling system.

For vehicles with long, or uphill radiator hoses, it may be necessary to lift the front of the vehicle, or fill the system from multiple locations. This may require installing the waterneck or upper radiator hose after some initial filling. Doing this will ensure that no big air pockets will be in the system.

THERMOSTAT:

Install a new performance thermostat equipped with a bypass hole. This allows trapped air to escape during heat cycles. As a general rule, we recommend a thermostat that will keep your cooling system in the OEM operating range. (example: 187 degrees is OEM on most GM LS3's.)

Once the system is capped and filled to the best of your ability, it's good practice to squeeze the lower hose several times to try and dislodge any trapped air in the block.

You will recheck the coolant level at the highest practical point **AFTER** the engine has been run through a heat cycle and allowed to **FULLY COOL!** You should also have a recirculating coolant bottle that can pull fluid back into the radiator once cool. A "catch can" that does not have a recirculation tube below the water level can lead to air being sucked back into the system.

4 FUEL REQUIREMENTS: Use premium gasoline or a gas/ethanol blend

We recommend you use **PREMIUM GASOLINE with a minimum octane rating of 91** for your high performance engine, unless otherwise noted on our website. Fuel requirements may vary for engine types. Visit www.BluePrintEngines.com and click the recommendations tab on your engine's product page to view its octane requirements.

5 ENGINE START-UP AND BREAK-IN PROCEDURE

! SAFETY FIRST: Before starting your engine, be sure to set the emergency brake. If the vehicle is on the ground, chock the wheels and make sure the vehicle cannot slip into gear.

Note that engines shipped with ECU's do come with a startup tune. Engines shipped without ECU's will require professional level tuning before ANY street miles.

Since the LS is a ROLLER CAM ENGINE, your initial start-up will basically be to check for leaks and to heat cycle components that may need retightened, such as intakes, headers, etc., as seen earlier in this guide.

While the engine is running, be sure to check oil pressure, coolant temperature, and check for fluid leaks, such as oil, transmission fluid, fuel, and coolant/antifreeze. Listen for any unusual sounds. Should you hear an unusual sound, shut the engine off, check for the source, and correct it.

6 POST INITIAL START-UP / HEAT CYCLE CHECK

! After you have started your engine, and have run it through several heat cycles, it's important to recheck all fasteners and fluid levels. It's not uncommon for external fasteners to need retorqued after the engine has been brought to temperature several times.

With engine still warm:

Recheck intake manifold bolts, header bolts, carburetor mounting stud nuts, water pump bolts, and valve cover bolts.

Once engine cools:

Recheck all fluid levels, all front accessory drive bolts, torque converter bolts, distributor hold down bolt/stud, and starter bolts.

7 FIVE HUNDRED MILE BREAK-IN

! NOTE: DO NOT use synthetic oil during the break-in period!!! It is not recommended, required, or necessary.

For your engine's first 500 miles, avoid hard acceleration for sustained periods. Periodically change the engine speed while driving to help seat the rings. After the first 500 miles, change the oil and the oil filter.

Since the LS is a Roller cam engine, you are not required to run an oil with zinc. A standard 10W30 is all that is required.

If you are running without catalytic converters installed, you may also use BPP10W30 crate engine oil. This does contain zinc, which is not detrimental to the engine, but can clog catalytic converters over long periods of time.

BluePrint Engines does not find the use of synthetic oils to be necessary or beneficial. If you must run synthetic, it is only advised after 9,000 miles and only on roller cam engines. Synthetic oils by composition are thin and "slicker" than fossil oils. They tend to increase leaks and can promote improper break-in. Please take this into consideration before changing to a synthetic oil.

MAINTENANCE

- Do NOT use synthetic oil during the break-in period!! Even after break-in, synthetic oil is NOT required, and not necessary for BluePrint Engines. If you must run a synthetic, please wait 9,000 Miles.
- During the break-in period, check all fluid levels frequently.
- Recheck external bolts that may loosen with use or heat cycles, such as intake manifold, headers/exhaust, front accessories, etc.
- Change the oil and oil filter every 3,000 miles, or 3-4 months if not driven regularly. If your engine is used in a heavy duty or dusty environment, the oil and oil/air filters should be changed more frequently.
- In colder regions, lower viscosity oil may be required for better flow characteristics.
- Use premium gasoline as recommended for your engine at www.BluePrintEngines.com.

DYNO TESTING

Every BluePrint Engine comes with YOUR Dyno sheet! That's the BluePrint Engines Dyno Promise! If you misplace or can't locate your sheet, contact our service department with your engine's serial number and we will gladly provide it for you. (Serial numbers are six digits and located on the block.) Every BluePrint Engine shipped with an oil pan and cylinder heads is dyno tested. We then do multiple pulls on the dynamometer to determine and record the torque and horsepower readings over a range of RPM readings to ensure your engine meets or exceeds its design specifications. We monitor critical temps, oil pressure, AFR, leak inspection, and perform a comprehensive oil filter and oil analysis test. The crankcase is then drained and your engine is approved and prepared for shipping.

WARRANTY REGISTRATION

To Register your BluePrint Engines Limited Warranty, go to www.BluePrintEngines.com and complete the registration form as soon as your engine is installed. With proper installation, break-in and maintenance, you can look forward to years of trouble-free performance.

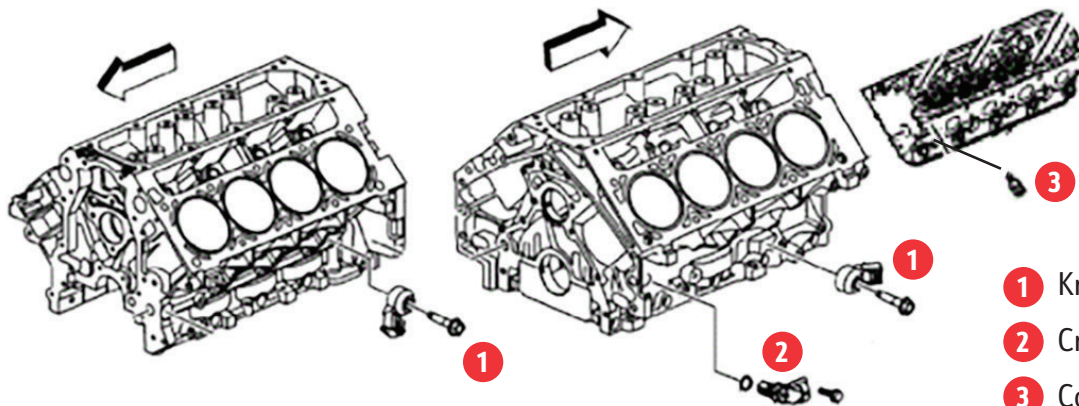
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Sales: (308) 236-1010 • Support: (308) 236-1050 • International: 1-800- 483-4263

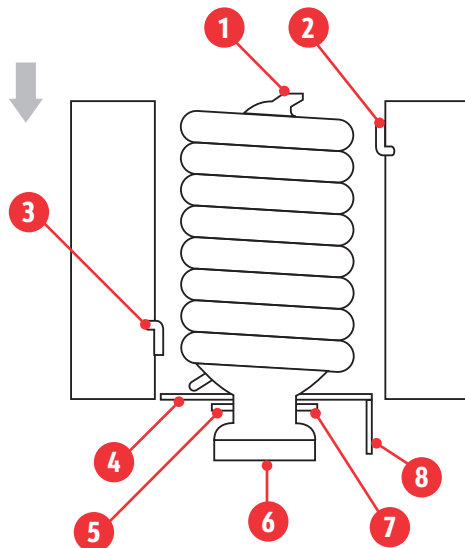
Email: info@blueprintengines.com

Website: www.BluePrintEngines.com

ALUMINUM BLOCK SENSOR LOCATIONS



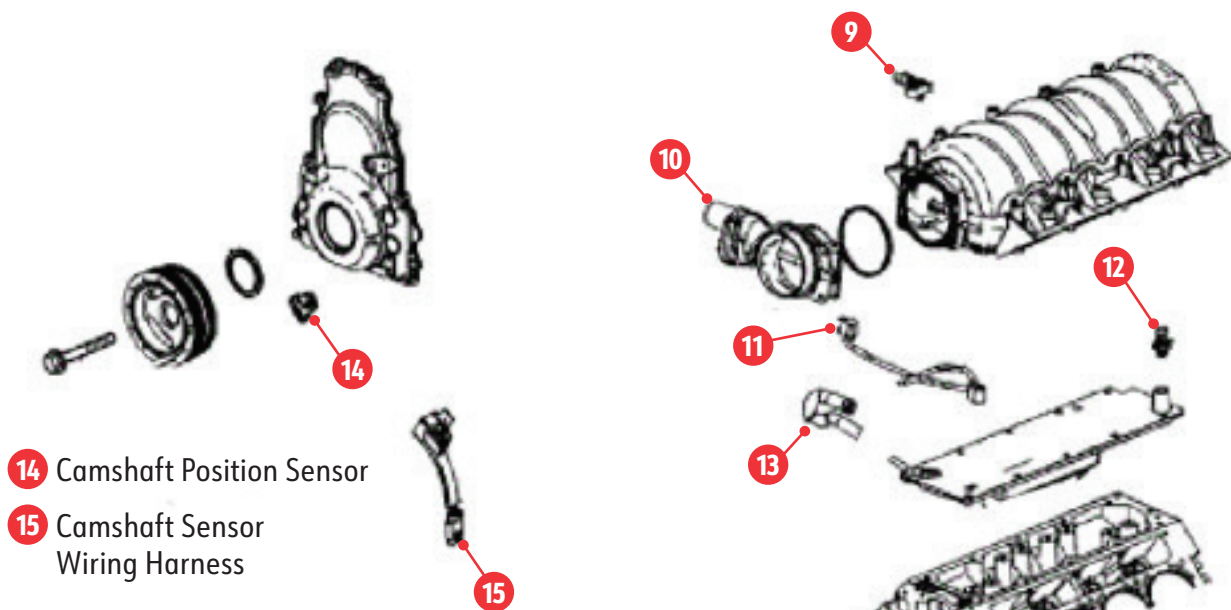
- 1 Knock Sensors
- 2 Crankcase Position Sensor
- 3 Coolant Temperature Sensor



- 1 To Power Break Vacuum Assist
- 2 Crankcase Ventilation
- 3 Crankcase Ventilation
- 4 Ventilation from Lifter Valley
- 5 Dirty Air Return
- 6 Throttle Body
- 7 Dirty Air Return

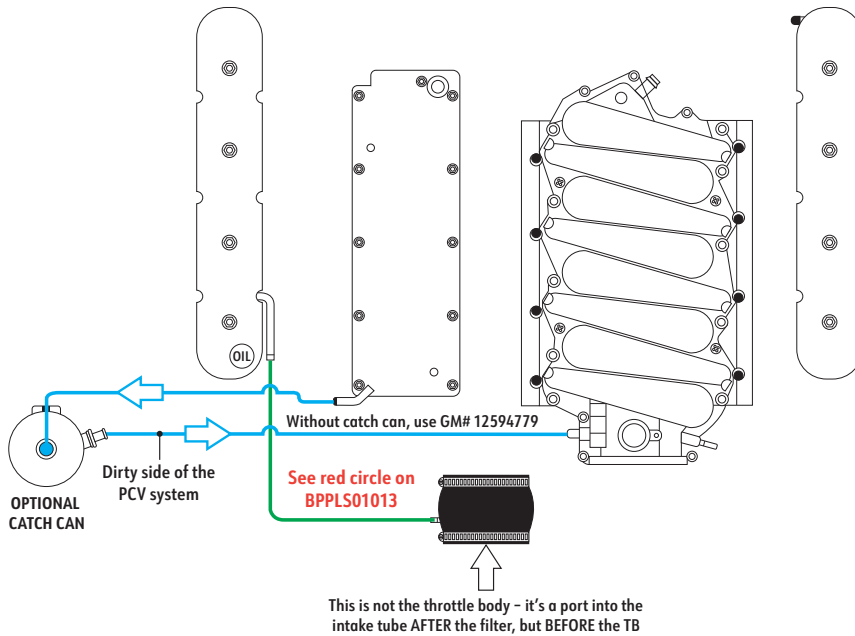
- 8 Engine Coolant Air Bleed
- 9 Manifold Absolute Pressure Sensor
- 10 Throttle Body
- 11 Engine Coolant Air Bleed
- 12 Oil Pressure Sensor
- 13 Ventilation Hose (not supplied)

Vacuum Hose Routing – #2 and #7 should be capped. #3 would need to be connected in front of the throttle body but after the MAF sensor. #4 and #5 need to be connected with #13 hose.

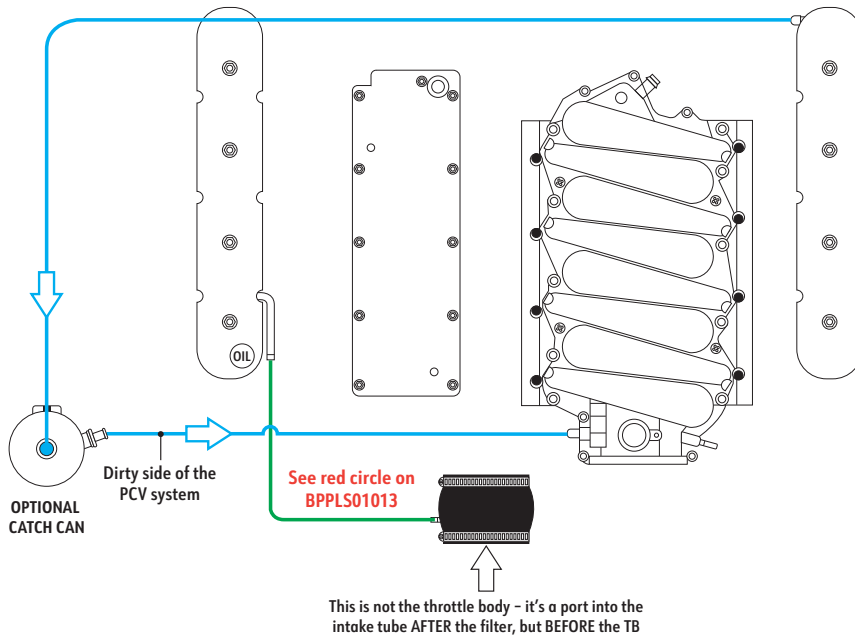


- 14 Camshaft Position Sensor
- 15 Camshaft Sensor Wiring Harness

PCV HOSE ROUTINGS (LS3 BASED ALUMINUM BLOCK ENGINES)

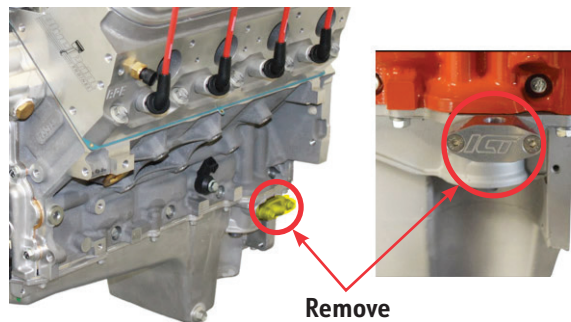


PCV HOSE ROUTINGS (6.0 BASED IRON BLOCK ENGINES)



OIL PRESSURE RELOCATION

If the oil pressure sensor won't fit up in the rear of the intake, you can remove the plate highlighted in yellow and install **ICT Billet's 551534** oil sensor relocation adapter, or a similar one to provide oil pressure down by the oil filter. ITC Billet also makes a similar one that has two output ports if you need to run an oil cooler or have other sensors.



COOLANT TEMPERATURE SENSOR ADAPTER

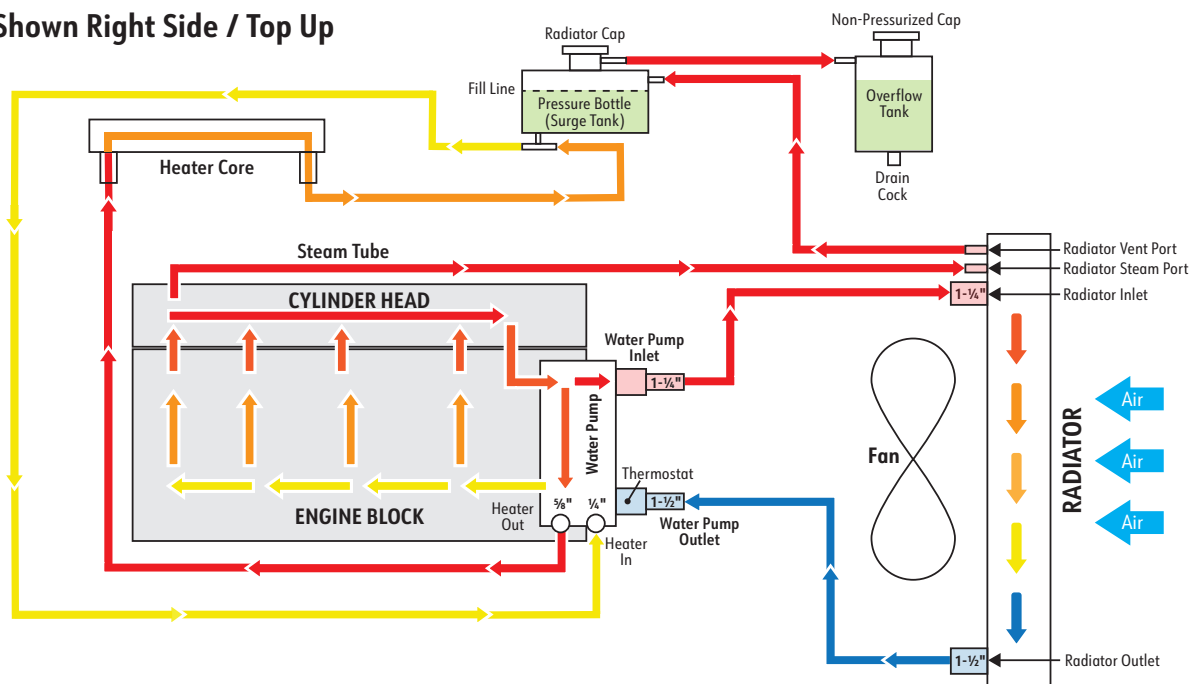


ICT Billet makes an LS Swap Gauge Sensor to go from the stock LS M12-1.5 to female 3/8" NPT if you want to run your old coolant sensor.

This would be handy for our **PSLS4270CTC** engine that runs a carb.

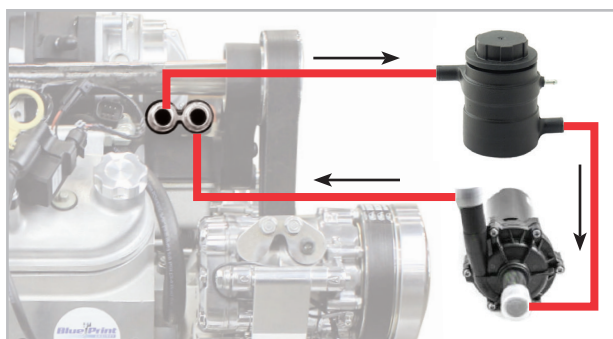
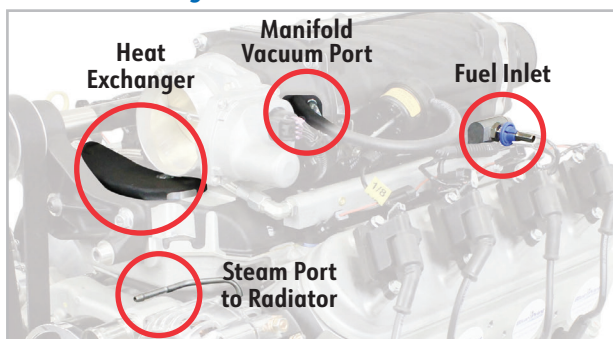
LS COOLANT PATH FLOW

Shown Right Side / Top Up



SUPERCHARGED LS COOLANT ROUTING

PSLS4272SCT Magnuson Blower info



THROTTLE BODY WIRING ADAPTER

Chevrolet Performance Throttle Body Wiring Adapter
SDTRKADPTG

Adapts LS2, LS3, LS7, and L99 90mm or L92 87mm 6-pin gold blade throttle body to 78mm 8-pin harness. For use on 2003-06 and 2007 classic full size GM trucks, 2004 Chevrolet SSR, and 2004-05 Holden VZ LS1 vehicles.



OIL PAN OPTIONS

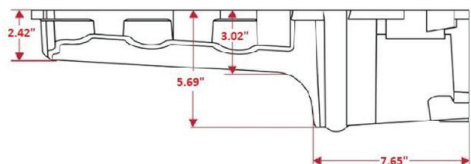
Our 427 LS engines they feature a 4.125" stroke and is different than the GM 7.0 which uses a larger bore and shorter stroke. You must make sure the oil pan can clear the longer stroke of our engine. BluePrint Engines sells several oil pan options separately. For all oil pan specs, prices, and direct ordering, enter the part number in the search bar at www.BluePrintEngines.com.

Standard GM Muscle Car LS Pan (Installed on all BluePrint Engines)



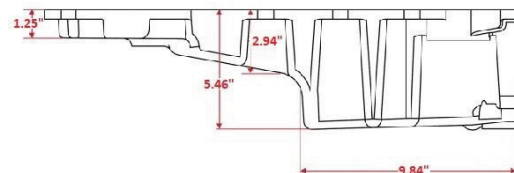
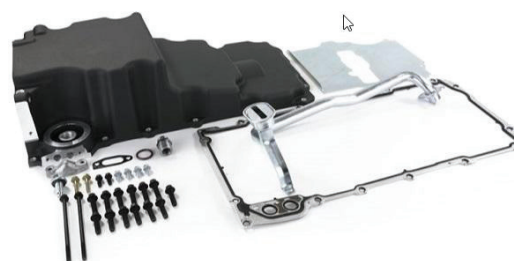
BPP81074 / BPP81074BK

Works with many 1955-87 GM vehicles originally equipped with SBC or BBC.



BPP81073 / BPP81073BK

Designed to work with vehicles with lower ground clearance like the FFR 33 Hotrod / 35 Truck. Also works with many 1955-87 GM vehicles. (Note this will not fit LS stroker engines.)



Show us your muscle!

We love seeing where our engines end up, so we're always on the hunt for customer photos and stories. After you've installed your beast, take a couple snapshots and submit them to our photo gallery at BluePrintEngines.com. We'll post them online with a few details for others to see – and enjoy! So what are you waiting for? Send us your photos!



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www.instagram.com/blueprint_engines

SW325 BLUEPRINT INSTALLATION INSTRUCTIONS • 9/17/21

BLUEPRINT ENGINES

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