Inside Sealing

Chevrolet Generation III Small-Block V8

Who: For shop owners and technicians

What: Tips for engine sealing repairs

Where: Visit www.felpro-only.com for more information

Why: Leverage the expertise of Federal-Mogul's Fel-Pro® engineering team to grow your engine sealing business

Highlights:

- Market opportunities for rebuilders
- Head gasket selection and installation
- Surface preparation for MLS technology
- Valve cover and oil pan sealing
- Intake manifold gasket selection and fit

Chevrolet LS Series

Engine Models	Engines in Service
5.7L (1997-05) VIN G, S	405,820
4.8L (1999-08) VIN C, V	1,271,762
5.3L (1999-08) VIN B, C, J, L, M, P, T, Z, O, 3	4,426,484
6.0L (1999-08) VIN H, K, N, U, Y, 5	1,832,437

Opportunity Abounds in GM's Modern Small Block

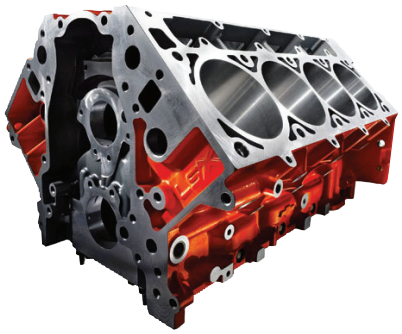
In 1997 General Motors introduced an engine platform worthy of the legacy established by the venerable first-generation small-block engine. Over the years, the Chevrolet brand has utilized three basic small-block architectures: the original, offered from 1955-1995; the LT Series, 1992-97; and this month's featured platform, the LS, introduced in 1997. The idea behind the LS was to create a more powerful, efficient and flexible (multiple displacements, front drive/rear drive) platform for use in a variety of passenger car and light truck applications.

Interestingly, GM chose the more traditional cam-in-block pushrod-style architecture rather than a single- or dual-overhead-cam setup.

Simply put, the LS Series small-block might be the best V8 engine ever produced by GM. Initially offered as a 5.7L 346-cubic-inch performance engine, the LS platform now includes 4.8L, 5.3L and 6.0L versions for light trucks. These engines also have become favorites among hot rodders due to their positive response to bolt-on "power adders" (intakes, cylinder heads, etc.).

Common Leaks

Among the most commonly encountered sealing needs on LS Series engines are: (1) head gasket replacement/upgrade (automotive and/or performance); (2) valve cover and oil pan sealing; and (3) replacement/upgrade of stock and/or performance intake manifold gaskets.



Fel-Pro Solutions

1.) PermaTorqueMLS® head gaskets with "stopper layer"

2.) PermaDry® valve cover and oil pan gasket sets

3.) Intake manifold gaskets featuring proprietary composite material and Printoseal® sealing beads

FEL-PRO
THE GASKETS PROFESSIONALS TRUST™

GM's Aluminum Marvel

LS Series Engines Offer Plenty of Opportunity


John Gurnig

By John Gurnig

Field Test Technician

A good way to judge the business opportunity associated with a modern engine design is to take a look at the books that have been written about it. If there are only a few books available from reputable automotive sources, your opportunity is probably limited.

GM's LS Series engine platform has spawned several books from leading engine professionals. That's not really surprising, given the ample opportunities to modify these very reliable engines for a wide range of duties. In short, LS Series engines are true racing thoroughbreds that can also be used with great success and customer satisfaction in an automotive or light truck application. We've seen them in drag racing series, such as the NMRA, where teams are using nitrous oxide, superchargers/turbochargers and are running on 10-inch tires. Another very popular application is in "spec" engines for circle track competition such as the NASCAR weekly series.

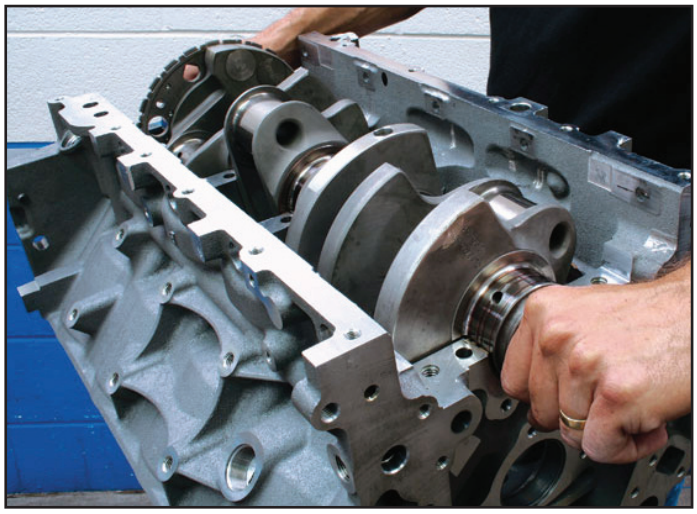
What's different about the LS Series as compared to GM's Gen I and II platforms? Here are a few highlights:

- Aluminum oil pan stabilizes lower engine and transmission
- Block features "deep skirt" for greater rigidity
- No distributor
- Coil-near-plug ignition system
- Uses cam and crank position sensors
- Does not use the traditional GM firing order; the LS sequence is **1-8-7-2-6-5-4-3**
- 100 lbs. lighter than Gen I & II engines

Key to the success of this engine platform is its ability to make great power with decent fuel economy and excellent overall durability. The LS features six-bolt main bearing caps (four vertical, two side-drilled), which provide a great base in which to make power.

Head Sealing Tips

GM engineers obviously discovered how creative today's engine builders could be in enhancing the power of LS Series engines. This might explain why these engines transitioned in 2002 from conventional composite-style head gaskets to multi-layer-steel gaskets. The MLS design is the better choice, as it allows you to create significantly more power while preventing the combustion leakage that can occur



when the cylinder head lifts away from the block. Unlike composite-style head gaskets, MLS gaskets offer "recoverability" from this lift, thereby maintaining contact pressure between the head and block.

The use of MLS technology requires specialized knowledge related to surface finish and flatness. These topics are covered on Page 3 of this issue.

In terms of general head gasket installation tips, I'll keep them simple:

- Always clean and chamfer the head-bolt holes. Remember, this is an aluminum block (pass-car applications), so you don't want any hidden debris damaging the threads. Clean the block threads to remove the sealer from the previous head bolts.
- Only use high-quality fasteners, and double-check with thread gauges before installing. Fel-Pro offers the head bolts required for this family of engines.
- Remove the black oxide coating from the threads as well as the thrust faces of all nuts and washers.
- Be sure to "prep" the fasteners with a light coat of engine oil (except those fasteners that come with pre-applied sealer). Be sure to coat all of the threads and the underside of the bolt head.
- Torque the fasteners in stages following the manufacturer's recommended procedures.
- A "cold retorque" procedure is recommended.
- Be sure to calibrate your torque wrenches!

John Gurnig runs the Fel-Pro Field Test Garage in Skokie, Ill.

Head Gasket Repairs

Mastering the Use of MLS Gaskets

LS Series engines are now almost universally equipped with multi-layer-steel head gaskets. As a pioneer in MLS technology, Federal-Mogul's Fel-Pro brand is the preeminent source of standard automotive and performance MLS head gaskets for rebuilders across North America.

Fel-Pro PermaTorqueMLS head gaskets for LS Series engines feature four layers of full-hard stainless steel encapsulated in a proprietary high-temperature coating designed specifically for the repair/rebuilding environment. In addition, these gaskets feature an extra, "stopper" layer that provides a superior primary combustion seal.

MLS technology is needed in these and a growing number of other engine platforms because of its ability to absorb the vertical head "lift" caused by the combustion process, as well as the horizontal "shearing" action between the head and block. MLS gaskets also can withstand higher operating temperatures than can composite designs.

Surface Finish Requirements

It is crucial to understand that MLS gaskets have different surface finish requirements than composite-style gaskets. These tighter requirements are offset to some degree by the exclusive aftermarket coating utilized on Fel-Pro PermaTorqueMLS gaskets. This coating permits engine builders to achieve an ideal seal by ensuring the following surface characteristics:

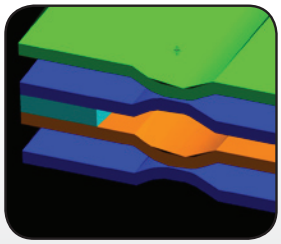
- Ra = Maximum 30 µin (PermaTorqueMLS is 60-plus!)
- Rz = Maximum 360 µin
- Wt = Maximum 400 µin for waviness with peak spacing between .030" to .100"
- Waviness peak spacing should be not be less than .030"

Fel-Pro PermaTorqueMLS Technology

- Full-hard stainless steel layers
- Embossed beads function as spring to absorb head "lift"
- Bead height, width and shape controlled to provide precise spring rate
- Each layer coated with proprietary conformable coating for the aftermarket repair environment from all coolant passages.

MLS Fundamentals

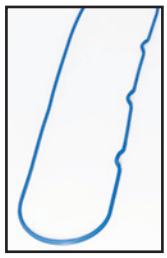
- Embossed beads function as a spring
- The height, width, and shape of the embossed bead determines its spring rate
- Beads maintain sealing stress during extreme operating conditions
- MLS gaskets will withstand higher operating temperatures and greater head-to-block motion than conventional gaskets



Other Repairs

Install 'em dry; intake manifold sealing options

NOTE Fel-Pro offers PermaDry® molded-rubber valve cover gaskets that mirror the OE technology on LS Series engines. Be sure to install these gaskets dry (no adhesives or sealants) – that's why they carry the PermaDry brand. Also, it's never a good idea to re-use valve cover gaskets, so don't cut corners here. You could end up having to redo the job later on.



NOTE Oil pan gaskets available for the LS Series also feature PermaDry molded-rubber technology, which means they should be installed dry. Fel-Pro also offers its patented oil pan Snap-Ups™ for these engines. (Ask for Fel-Pro p/n ES72865.) These invaluable tools hold the gasket in place so there's no need for an extra set of hands when installing the pan.

NOTE Fel-Pro manufactures stock replacement and performance-style intake manifold gasket sets for LS engines. The stock replacement gasket features a nylon carrier with a molded-rubber bead system that seals to each intake port. These gaskets also feature hang tabs that position the gasket in relation to the intake manifold.

The Fel-Pro performance intake manifold gaskets feature 1.19" x 3.34" intake

ports and are available in five thicknesses to match a variety of intake and cylinder head combinations. They also can be trimmed to match ported cylinder heads. In addition, some versions feature supplemental Printoseal sealing beads for added contact stress.

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GM LS Series Parts Check

100 PERCENT VEHICLE SEALING

Only Fel-Pro offers 100% application-specific sealing solution components for GM LS Series engines. Each Fel-Pro gasket and seal for these applications features the best material and design for the aftermarket repair environment.

Repair Type		Repair Type	
Cooling System	Thermostat Gaskets	**Exhaust System**	EGR Valve Gaskets
	Water Pump Gaskets		Exhaust Manifold Gasket Sets
			Exhaust Pipe Gaskets
Engine Repair	Conversion Gasket Sets	**Emissions/ Fuel System**	Fuel Injector O-Ring Sets
	Crankshaft Repair Sleeve & Tool		Throttle Body Mounting Gaskets
	Head Bolt Sets		
	◆ Head Gaskets	**Leak Repair**	Intake Manifold Gasket Sets
	◆ Head Gasket Sets		◆ Oil Pan Gasket Sets
	Grommet Sets		◆ Valve Cover Gasket Sets
	Long Block Gasket Sets		◆ Rear Main Seal Sets
	◆ Short Block Gasket Sets		Timing Cover Gasket Sets
	◆ Valve Stem Seal Sets		

◆ Premium materials available.

Chevrolet LS Series Torque Specifications

Engine	Years	Ft.-Lbs.
293 OHV (4.8L) Chevrolet Truck	2008-07 VIN C 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
293 OHV (4.8L) Chevrolet Truck	2008-04 VIN V 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
293 OHV (4.8L) Chevrolet Truck	2004-99 VIN V 1st Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-8 turn 90 degrees, 4th M11 Bolts 9-10 turn 50 degrees, 5th M8 bolts 11-15 22
325 OHV (5.3L) Chevrolet	2008-05 VIN C 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
325 OHV (5.3L) Chevrolet Truck	2008-07 VIN J, L, 0, 3 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
325 OHV (5.3L) Chevrolet Truck	2008-04 VIN B, M, P, T, Z 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
325 OHV (5.3L) Chevrolet Truck	2004-99 VIN P, T, Z 1st Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-8 turn 90 degrees, 4th M11 Bolts 9-10 turn 50 degrees, 5th M8 bolts 11-15 22
346 OHV (5.7L) Chevrolet	2005-04 VIN G, S 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
346 OHV (5.7L) Chevrolet	2004-97 VIN G, S 1st Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-8 turn 90 degrees, 4th M11 Bolts 9-10 turn 50 degrees, 5th M8 Bolts 11-15 22
364 OHV (6.0L) Chevrolet	2008 VIN Y, 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
364 OHV (6.0L) Chevrolet	2007-05 VIN H, U 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
364 OHV (6.0L) Chevrolet Truck	2008-07 VIN K, Y, 5 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
364 OHV (6.0L) Chevrolet Truck	2008-04 VIN H, N, U 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
364 OHV (6.0L) Chevrolet Truck	2004-99 VIN N, U 1st Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-8 turn 90 degrees, 4th M11 Bolts 9-10 turn 50 degrees, 5th M8 bolts 11-15 22
378 OHV (6.2L) Chevrolet	2008 VIN W 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
378 OHV (6.2L) Chevrolet Truck	2008-07 VIN 8 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22
427 OHV (7.0L) Chevrolet	2008-06 VIN E 2nd Design Bolts	1st M11 Bolts 1-10 22, 2nd M11 Bolts 1-10 turn 90 degrees, 3rd M11 Bolts 1-10 turn 70 degrees, 4th M8 Bolts 11-15 22