2009 "LS4" 5.3L V-8 (LS4)
5.3L V-8 (LS4) CAR ENGINE

Carryover features and benefits from 2008 model year

- E67 Engine Control Module
- 58X Ignition System
- Improved MAP Sensor
- Oil Filter with Internal Bypass
- BIN 5 Emissions Standard

The "LS4" 5.3L V-8 continues in 2009 model year in the Buick LaCrosse "Super" and the Chevrolet Impala SS. The "LS4" in these vehicle applications are mated with the Hydra-Matic 4T65 (MN7) front wheel drive automatic transmission.

E67 Engine Control Module
An advanced controller manages the multitude of operations that occur within the 5.3L car V8 every split second. The E67 is the high-line controller in GM's new family of three engine control modules (ECM), which will direct nearly all the engines in Powertrain's line-up. It features 32-bit processing, compared to conventional 16-bit processing, with 32 megabytes of flash memory, 128 kilobytes of RAM and a high-speed CAN bus. It synchronizes more than 100 functions, from spark timing to cruise control operation to traction control calculations, and it will work in vehicles with different generation vehicle wiring systems, or LANs. The E67 has more computing power than the typical desktop PC 20 years ago. It works more than 50 times faster than the first computers used on internal combustion engines in the late 1970s, which managed five or six functions.

The family strategy behind GM's new ECMs allows engineers to apply standard manufacturing and service procedures to all powertrains, and quickly upgrade certain engine technologies while leaving others alone. It creates both assembly and procurement efficiencies, as well as volume sourcing. In short, it creates a solid, flexible, efficient engine-control foundation, allowing engineers to focus on innovations and get them to market more quickly. The family of controllers means the ECM and corresponding connectors can be packaged and mounted identically in virtually every GM vehicle. Powertrain creates all the software for the three ECMs, which share a common language and hardware interface that's tailored to each vehicle.

With the E67, control software and calibration for the 5.3L LS4 V8's Active Fuel Management cylinder-deactivation technology (see Overview) has been enhanced. The new calibration is optimized to increase the percentage of LS4 operation in fuel-saving four-cylinder mode.

58X Ignition System
The 5.3L LS4 uses an advanced 58X crankshaft position encoder to ensure that ignition timing is accurate throughout its operating range. The new 58X crankshaft ring and sensor provide more immediate, accurate information on the crankshaft's position during rotation. This allows the E67 ECM to adjust ignition timing with greater precision, which optimizes performance and economy. Engine starting is also more consistent in all operating conditions.

In conjunction with 58X crankshaft timing, the LS4 applies the latest digital cam-timing

technology. The cam sensor reads a 4X sensor target on the cam sprocket. The target ring has four equally spaced segments that communicate the camshaft's position more quickly and accurately than previous systems with a single segment. The dual 58X/4X measurement ensures extremely accurate timing for the life of the engine. Moreover, it provides an effective back-up system in the event one sensor fails.

Advanced MAP Sensor
An advanced manifold absolute pressure (MAP) sensor completes upgrades to the 5.3L LS4's control system. The MAP sensor is a variable resistor used to monitor the difference between atmospheric and manifold pressure, which tends to increase when the engine is operating under a higher load or at wide-open throttle. The ECM uses information from the MAP sensor to adjust spark timing and fuel delivery to optimize performance and minimize emissions.

In the LS4, the sensor has been moved to a new location on the intake manifold further from the throttle body. This improves fidelity by isolating the sensor from disturbances caused by the throttle's movement, and takes full advantage of the E67 ECM's capabilities.

Oil Filter with Internal Bypass
The 5.3L LS4's oil filter now features an internal filter bypass. The bypass is a safety device that protects the engine in the event the filter is neglected for an extended period. If the filter becomes completely clogged with debris, the bypass opens and prevents the filter from restricting oil flow through the engine.

Previous LS4s had the bypass mechanism installed in the oil pan. Moving the bypass to the filter improves engine assembly efficiency and insures that the mechanism is fresh and unobstructed each time the filter is changed.

BIN 5 Emissions Standard
The 5.3L V8 for cars is now certified to BIN 5 tail pipe emissions standards in all applications. It achieves this standard thanks to control efficiencies allowed by the E67 ECM and a reformulation of the precious metals in its catalytic converter. Metals such as platinum, palladium and rhodium in the converter's catalytic substrate create the chemical reaction that turns the majority of exhaust emissions into oxygen and water vapor. With returnless fuel injection and the latest sealing technology for the intake system, the 5.3L V8 generates essentially zero evaporative emissions. This engine is 90 cleaner than that in the typical automobile sold just three years ago.

Overview
The 5.3L LS4 V8 is a landmark engine on several counts. It's the first small-block V8 developed for front-wheel drive application. When it was introduced in the 2005 Pontiac Grand Prix GTP, it created the first V8-powered Grand Prix since the last rear-drive platform in 1987. The LS4 was also the first car engine with GM Powertrain's industry exclusive Active Fuel Management (AFM) technology. A year after its launch, the LS4 powered the return of two cars revered by auto enthusiasts: The Chevrolet Impala SS and Monte Carlo SS.

The LS4's aluminum cylinder block shares its basic architecture with the 6.0L LS2 V8 available in the Chevrolet Corvette. This Gen IV small block's identifying feature is its

external knock sensors, moved from inside the V, or valley, to make room for advanced technologies such as AFM. Yet refinements in this latest small block go much deeper, with features such as deep-skirt cylinders, six-bolt cross-threaded main bearing caps, a structural oil pan, and other vibration-reducing, weight-saving design elements.

The 5.3L LS4, however, was designed to mount transversely (sideways), compared to the longitudinal installation of the 6.0L LS2 and every small block V8 before it. Its crankshaft is shortened 13 mm – 3 mm at the flywheel end and 10 mm at the accessory drive end – to reduce the length of the engine compared to the 6.0L. All accessories are driven by a single serpentine belt to save space. The water pump is mounted remotely with an elongated pump manifold that connects it to the coolant passages. Revised oil pan baffles, or windage trays, are incorporated into the LS4 to ensure that the oil sump stays loaded during high-g cornering. With its front-drive layout, the LS4's exhaust manifolds are joined by a crossover pipe, with a single, high capacity underbody catalytic converter.

Like all Gen IV V8s, the 5.3L LS4 was designed for low maintenance. Its spark plugs and coolant were developed to last 100,000 miles—with the same performance at 10,000 miles and 90,000 miles. The PCV valve is a maintenance-free fixed orifice, not a perishable item. Maintenance is limited to oil changes, and even those are made as infrequent as possible thanks to the GM Oil Life System. With this system, the engine control module (ECM) records cumulative data on a number of variables, including engine rpm, temperature, load or rpm variance and length of operation at any given load and temperature. Using this information, the system calculates oil degradation and recommends an oil change when the oil is near the end of its useful life – in other words, when an oil change is actually needed, as opposed to a predetermined mileage interval.

An advanced up-integrated electronic throttle control system is standard, making ETC more robust and responsive than ever. Yet the LS4 technology that has garnered the most attention is its Active Fuel Management cylinder deactivation. In certain light-load conditions, AFM shuts down alternate cylinders on each bank, and the LS4 effectively operates as an efficient V4. When a driver demands full acceleration, the engine instantly returns to V8 operation. The transition occurs in milliseconds and is virtually imperceptible.

The keys to AFM's efficiency are advanced capabilities built into the ECM and a set of special two-stage hydraulic valve lifters. These De-ac lifters are installed for cylinders that shut down in V4 mode. They have inner and outer bodies which normally operate as a single unit. When the engine controller determines cylinder deactivation conditions are optimal, it activates solenoids in the engine lifter valley, which in turn direct high-pressure oil to the switching lifters. This oil pressure activates a release pin inside the lifter, allowing the outer body on the De-ac lifter to collapse around the inner body. The shortened lifters move with the camshaft, but do not move the pushrod or operate the valves on their cylinders. When the ECM wants V8 power, it stops the flow of oil to the De-ac lifters. The locking pin releases and all valves begin operating.

With good specific output, the 5.3L LS4 V8 also delivers torque in exceptionally linear fashion--90 percent of its 323 lb-ft is available between 1500 rpm and 5200 rpm – and surprising fuel economy. Its front-drive installation once again demonstrates the inherent packaging flexibility in the small-block V8. With this new small block, the engineers and analysts who claimed cam-in-block engines could not meet the demands of a new

millennium--or increasingly stringent emissions standards—were proven patently wrong.