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CHEVROLET ENTERS THE WORLD OF SUPERCARS WITH 2009 CORVETTE ZR1

New, Supercharged LS9 V-8 is the Heart of the ZR1

DETROIT – Chevrolet officially announced the 2009 Corvette ZR1 – an American supercar that brings the technology and engineering refinement of carbon-fiber, ceramics and electronics together in a distinctive design.

“Chevrolet’s goal with the new ZR1 is to show what an American supercar can deliver, at a price that trumps exotics that cost two, three or four times as much – and does so with exceptional driveability,” said Ed Peper, Chevrolet general manager.

The ZR1’s basic stats:

- All-new LS9 supercharged 6.2L V-8 targeted at producing at least 100 horsepower per liter, or 620 horsepower (462 kW), and approximately 595 lb.-ft. of torque (823 Nm)
- Six-speed, close-ratio, race-hardened manual transmission
- New, high-capacity dual-disc clutch
- Higher-capacity and specific-diameter axle half-shafts; enhanced torque tube
- Specific suspension tuning provides more than 1g cornering grip
- Twenty-spoke 19-inch front and 20-inch rear wheels
- Michelin Pilot Sport 2 tires – P285/30ZR19 in front and P335/25ZR20 in the rear – developed specifically for the ZR1
- Standard carbon-ceramic, drilled disc brake rotors – 15.5-inch-diameter (394-mm) in the front and 15-inch-diameter (380-mm) in the rear
- Larger brake calipers with substantially increased pad area
- Standard Magnetic Selective Ride Control with track-level suspension
- Wider, carbon-fiber front fenders with ZR1-specific dual vents
- Carbon-fiber hood with a raised, polycarbonate window – offering a view of the intercooler below it
- Carbon-fiber roof panel, roof bow, front fascia splitter and rocker moldings with clear-coated, exposed carbon-fiber weave
- ZR1-specific full-width rear spoiler with raised outboard sections

- Specific gauge cluster with boost gauge (also displayed on the head-up display) and 220-mph (370 km/h) speedometer readout
- Only two options: chrome wheels and a “luxury” package
- Curb weight of approximately 3,350 pounds (1,519 kg)

The specialized components of the new ZR1 work harmoniously to deliver the most powerful and fastest automobile ever produced by General Motors. Performance estimates will be announced closer to vehicle’s summer 2008 launch.

“Preliminary testing shows the ZR1 builds on the highly respected Corvette Z06 in every performance category, from acceleration and braking, to cornering grip and top speed,” said Peper. “It all boils down to the power-to-weight ratio and the ZR1’s is exceptional – better than the Porsche 911 GT2, the Ferrari 599 and even the Lamborghini LP640. In fact, the ZR1 is expected to be the first production Corvette to achieve a top speed of at least 200 mph.”

Supercharged LS9 engine

The new LS9 6.2L small-block engine is the power plant that supports the ZR1’s performance capability. The enabler of the LS9’s performance and refinement is a large, positive-displacement Roots-type supercharger with a new, four-lobe rotor design. It is augmented with an integrated charge cooling system that reduces inlet air temperature for maximum performance.

A sixth-generation supercharger developed by Eaton helps the LS9 make big power and torque at lower rpm and carries it in a wide arc to 6,600 rpm, as it pushes enough air to help the engine maintain power through the upper levels of the rpm band – the area where supercharged performance tends to diminish. Heavy-duty and lightweight reciprocating components enable the engine’s confident high-rpm performance.

The LS9 is hand-assembled at GM’s Performance Build Center, in Wixom, Mich., and incorporates specialty processes typically seen in racing engines to produce a highly refined and precise product. For example, cast iron cylinder liners are inserted in the aluminum block and are finish-bored and honed with a deck plate installed. The deck plate simulates the pressure and minute dimensional variances applied to the block when the cylinder heads are installed, ensuring a higher degree of accuracy that

promotes maximum cylinder head sealing, piston ring fit and overall engine performance.

Transmission and axle

The LS9 engine is backed by a new, stronger six-speed manual transmission and a twin-disc clutch that provide exceptional clamping power, while maintaining an easy clutch effort. ZR1-specific gearing in the transmission provides a steep first-gear ratio that helps launch the car, and top speed is achieved in sixth gear – a change from the fifth-gear top-speed run-outs in the manual-transmission Corvette and Corvette Z06.

As the term implies, the twin-disc clutch system employs a pair of discs, which spreads out the engine's torque load over a wider area. This enables tremendous clamping power when the clutch is engaged, while also helping to dissipate heat better and extend the life of the clutch.

The twin-disc clutch system also contributes to the ZR1's exceptional driving quality, with smooth and easy shifting. The twin-disc system's design enables a 25-percent reduction in inertia, thanks to smaller, 260-mm plates, corresponding to a pedal effort that is similar to the Corvette Z06's 290-mm single-disc system.

The rear axle also is stronger in the ZR1 and features asymmetrical axle-shaft diameters that were developed after careful testing to provide optimal torque management. The axles are also mounted on a more horizontal plane that correlates with the wider width of the rear wheels and tires.

Ride and handling

The ZR1 is built on the same aluminum-intensive chassis as the Corvette Z06 and features similar independent SLA front and rear suspensions, with aluminum upper and lower control arms. Where the ZR1 differs is the suspension tuning, which was optimized for the car's steamroller-wide front and rear tires.

Magnetic Selective Ride Control is standard and tuned specifically for the ZR1. The system's ability to deliver a compliant ride with nearly instantaneous damping adjustments enabled engineers to develop a surprisingly supple ride quality in a supercar that still delivers cornering grip of more than 1g.

From a high-performance perspective, Magnetic Selective Ride Control helps the rear axle remain planted during launch for smooth, hop-free acceleration. It also helps suppress axle movement when cornering on broken or uneven pavement.

Brakes, wheels and tires

Commensurate with the ZR1's engine output is the braking system, which is headlined by carbon-ceramic brake rotors. Found on only a few exotics and more expensive supercars, carbon-ceramic brake rotors are made of a carbon-fiber-reinforced ceramic silicon carbide material. Their advantage comes in low mass and resistance to wear and heat. In fact, the rotors should never show any corrosion or require replacement for the life of the vehicle, when used in normal driving.

The vented and cross-drilled rotors on the ZR1 measure 15.5 inches (394 mm) in diameter in the front and 15 inches (380 mm) in diameter in the rear – making them among the largest carbon-ceramic rotors available on any production vehicle.

Clamping down on the high-tech rotors are six-piston front calipers and four-piston rear calipers, each painted a ZR1-exclusive blue. The front pads are equivalent in size to the largest on any production car with a single-pad design – double that of the Corvette Z06's 70-sq.-cm. front pads.

The brakes are visible through the ZR1's exclusive wheels: 20-spoke alloy rims that measure 19 inches in diameter in the front and 20 inches in the rear. They come standard with a bright, Sterling Silver paint finish and chrome versions are optional. The wheels are wrapped in Michelin Pilot Sport 2 tires developed specifically for the ZR1, measuring P285/30ZR19 in front and P335/25ZR20 in the rear.

Exclusive exterior

The ZR1 is instantly recognizable, with perhaps the most identifiable feature a raised, all-carbon-fiber hood that incorporates a clear, polycarbonate window. The window provides a view of the top of the engine's intercooler, with the legend "LS9 SUPERCHARGED" embossed on the left and right sides, and an engine cover with the Corvette crossed flags logo debossed at the front.

The underside of the hood has an exposed carbon-fiber-weave. Exposed carbon-fiber is used on the roof, roof bow, rocker molding and front splitter. These exterior components are protected by a specially developed glossy, UV-resistant clear coat that resists yellowing and wear.

Widened, carbon-fiber front fenders with specific, dual lower vents, and a full-width, body-color rear spoiler incorporating the center high-mounted stop lamp, are also unique to the ZR1. All of the exterior features of the car were developed to enhance high-speed stability and driver control.

Interior details

The ZR1's interior builds on the brand's dual-cockpit heritage, with high-quality materials, craftsmanship and functionality that support the premium-quality experience promised by the car's performance. The ZR1's cabin differs from the Corvette and Corvette Z06 with the following:

- ZR1-logo sill plates
- ZR1-logo headrest embroidery
- Specific gauge cluster with "ZR1" logo on the tachometer and a 220-mph (370 km/h) readout on the speedometer
- Boost gauge added to the instrument cluster and Head-Up Display

The "base" ZR1 (RPO 1LZ) comes with accoutrements based on the Z06, including lightweight seats and lightweight content. The uplevel interior package includes unique, power-adjustable and leather-trimmed sport seats (embroidered with the ZR1 logo); custom, leather-wrapped interior available in four colors; navigation system, Bluetooth connectivity and more.

By the numbers

In addition to the exterior cues and powertrain, ZR1 models will be distinguished from other Corvette models by their VIN. Each will carry a unique, identifying VIN digit, as well as a sequential build number. This makes it easy to determine the build number of a specific car – information treasured by enthusiasts and collectors. For example, a ZR1 with a VIN ending in "0150" would indicate it is the 150th ZR1 built for the model year.

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MORE THAN PERFORMANCE: CORVETTE ZR1' S CHASSIS AND SUSPENSION DELIVER A CONFIDENT, COMFORTABLE DRIVING EXPERIENCE

DETROIT – Its supercharged engine twists out more than 600 horsepower and nearly 600 lb.-ft. of torque. Its racing-inspired dual-disc clutch channels that power to a set of massive, 20-inch by 12-inch rear wheels, helping push the ZR1 to more than 200 mph (320 km/h). It also delivers more than 1g of lateral acceleration and stops with exceptional immediacy.

Yet for all its astounding performance attributes, the 2009 Corvette ZR1 has a refined driving experience that makes it a daily-driveable supercar.

“The ZR1 is a car anyone can drive confidently and comfortably,” said Tom Wallace, vehicle line executive. “From the very beginning, refinement, balance and compliance were targets that were as important as the car’s maximum performance.”

More than simply scaling wheel, tire and brake sizes to match the powertrain’s output, the ZR1’s engineers harmonized the chassis and suspension components to deliver a driving experience that combines an exceptional ride quality with racing-inspired performance. Enabling elements include standard Magnetic Selective Ride Control and new, Michelin Pilot Sport 2 tires that were developed specifically for the car.

“The ZR1’s handling performance builds on the Z06, but has ride compliance more like the base coupe,” said Tadge Juechter, Corvette chief engineer. “Every element from the stabilizer-bar diameters to the composition of the tires was carefully matched to deliver a balanced driving experience – it’s a supercar that doesn’t sacrifice ride quality for performance.”

Stopping power is derived from a carbon-ceramic-based brake system that is lightweight, heat resistant and wear resistant. While delivering braking performance similar to a racecar, it helps reduce the unsprung mass that the ZR1 would have accrued through the use of similarly sized cast iron brake rotors.

“It wasn’t enough to achieve the braking requirements commensurate with the car’s performance – we needed to find a solution that minimized the impact on the car’s balanced feel,” said Juechter. “A larger brake package generally means more weight,

but the carbon–ceramic rotors deliver excellent performance while also minimizing unsprung weight.”

Lightweight structure

The ZR1 has an aluminum structure for optimum stiffness and low mass. It is the same structure used on the Z06, but with specific body panels and drivetrain components mounted to it.

The chassis is constructed with perimeter rails made of strong, single-piece hydroformed aluminum members featuring cast suspension nodes. Other castings, stampings and extrusions are combined into the structure with state-of-the-art manufacturing technologies. Advanced structural composites featuring carbon–fiber are bonded to the aluminum structure. The passenger compartment floors, for example, combine carbon–fiber skins with an ultra-lightweight balsa wood core.

Like the Z06, the ZR1 has a magnesium cradle that serves as the attachment point for the engine and some front suspension components, with the new LS9 engine sitting slightly lower in the chassis than the Z06’s LS7 engine. Magnesium is lighter than aluminum yet incredibly strong. The magnesium cradle helps improve the front-to-rear weight distribution, as do the carbon–fiber front fenders, hood and wheelhouses.

To optimize the weight balance, the battery is located in the rear cargo area, behind the right rear wheel.

Suspension tuning and Magnetic Selective Ride Control

The ZR1 retains the 105.7-inch (2,686–mm) wheelbase of other Corvette models, as well as the short–long arm suspension and transverse spring design, but it rides on all–new, wider wheels and tires, stops with carbon–ceramic brakes and features specific spring and stabilizer bar rates – the largest–diameter stabilizer bars available on a Corvette. Also, the axle half–shafts are angled more horizontally to align with the different geometry created by the ZR1’s larger–diameter and wider rear wheels.

Magnetic Selective Ride Control (MSRC) is standard and tuned specifically for the ZR1. It is a real–time damping system that replaces conventional mechanical–valve shocks with electronically controlled shocks filled with a synthetic fluid containing

minute iron particles. Under the presence of magnetic charge, the iron particles align to provide damping resistance almost instantly.

MSRC “reads” the road in 1-millisecond intervals (a thousand times per second), making it the world’s fastest-reacting damping system. Its ability to deliver a compliant ride with nearly instantaneous damping adjustments enabled engineers to develop a surprisingly supple ride quality in a supercar that still delivers cornering grip of more than 1g.

“The damping control of MSRC allowed for front and rear springs that have a slightly lower rate than the Z06, which enhances the car’s ride quality,” said Juechter.

From a high-performance perspective, Magnetic Selective Ride Control helps the rear axle remain planted during launch for smooth, hop-free acceleration. It also helps suppress axle movement when cornering on broken or uneven pavement.

With cornering capability greater than the Z06, the ZR1’s powertrain was upgraded with a higher-capacity oil pump and larger-capacity oil reservoir. This ensures optimal oil pressure during the highest-load driving maneuvers.

Carbon-ceramic brakes

The ZR1 comes standard with carbon-ceramic brake rotors and large-capacity calipers at all four corners. The exotic carbon-ceramic rotors are made of a carbon-fiber-reinforced ceramic silicon carbide material, which offers low mass and exceptional resistance to wear and heat.

The vented and cross-drilled rotors on the ZR1 measure 15.5 inches (394 mm) in diameter in the front and 15 inches (380 mm) in diameter in the rear – making them among the largest carbon-ceramic rotors available on any production vehicle. And while large in size, they are low in mass, saving approximately 11 pounds (5 kg) per corner over comparably sized cast iron rotors.

The rotors are acted upon by six-piston front calipers and four-piston rear calipers, each painted a ZR1-exclusive blue. The front pads are equivalent in size to the largest on any production car with a single-pad design, measuring 148 sq. cm. in surface area – double that of the Corvette Z06’s 70-sq.-cm. front pads.

Braking performance of the ZR1 is nothing short of phenomenal, with the carbon-ceramic rotors and large calipers combining to provide exceptionally short, fade-free stopping during high-performance driving. The composition and durability of the non-metallic carbon-ceramic materials mean the rotors should never show any corrosion or require replacement for the life of the vehicle, when used in normal driving.

A new, Bosch brake-apply system is standard, and includes the brake master cylinder, booster and ABS control module. It is tuned specifically for the ZR1 and is not shared with other Corvette models. The system works with Magnetic Selective Ride Control to deliver a very competent and intuitive active handling system – complete with a Competitive Driving mode.

Michelin Pilot Sport 2 tires

The ZR1 rides on Michelin Pilot Sport 2 (PS2) tires, measuring P285/30ZR19 in front and P335/25ZR20 in the rear. And while the PS2 tire is familiar with enthusiasts, those on the ZR1 were engineered specifically for the car.

“We didn’t merely specify a set of off-the-shelf PS2s for the ZR1,” said Juechter. “Michelin’s engineers worked with GM to develop tires for the car that took into account factors such as the ZR1’s performance goals, expected horsepower, curb weight, weight distribution, aerodynamic downforce, top speed and more. The construction of these tires is unique to the ZR1.”

To save weight, there is no spare tire in the ZR1; the PS2 tires feature Michelin’s ZP technology and can be driven for a short distance with zero pressure until servicing can be attained.

Racing-inspired wheels

The ZR1 rides on exclusive 20-spoke alloy rims that measure 19 inches by 10 inches in the front and 20 inches by 12 inches in the rear, making them the largest ever offered on a Corvette. Their design was inspired by the multi-spoke racing wheels used on Corvette C6R racecars, which enhance the strength of the wheel at the rim. A bright, Sterling Silver paint finish is standard and a chrome version is optional.

The wheels, while slightly larger in mass than the smaller wheels of the Z06, were developed to be as lightweight as possible, minimizing the ZR1's unsprung mass.

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PERFORMANCE-DRIVEN DESIGN SUPPORTS THE CAPABILITY OF THE CORVETTE ZR1 – AND GIVES IT AN UNMISTAKABLE ATTITUDE

DETROIT – In 1990, the Corvette ZR-1 caused a stir with its wider quarter panels, convex rear fascia and squared taillamps. They were the visual clues that identified the special car, enhancing its status as an instant legend.

Spotting the '09 ZR1 at a glance is a snap, too, with its unique, carbon-fiber dual-port fenders, exposed carbon-fiber roof panel, rockers and front splitter, as well as a unique rear spoiler. Also exclusive to the ZR1 is a raised, carbon-fiber hood with a polycarbonate window that provides a view of the supercharged engine's intercooler that proclaims "LS9 SUPERCHARGED."

Enthusiasts may consider the ZR1's hood a crystal-clear glimpse at the soul of the ultimate Corvette.

"There is nothing subtle about the ZR1," said Kirk Bennion, exterior design manager. "It is a car that isn't shy about its capability."

While the exposed carbon-fiber elements and windowed hood symbolize the car's character, there are numerous other design details that are less obvious yet no less important to the ZR1's performance. They include:

- Carbon-fiber front fenders widened to accommodate the ZR1's larger front wheels and tires
- ZR1-specific twin vents in the front fenders
- Full-width rear spoiler with raised outboard sections incorporates the center high-mounted stop lamp
- ZR1-specific 20-spoke alloy wheels in Sterling Silver (chrome available)
- Nineteen-inch front wheels and 20-inch rear wheels inspired by C6R racecars

- Michelin Pilot Sport 2 tires; P285/30ZR19 in front and P335/25ZR20 in the rear
- ZR1-specific blue-painted brake rotors visible through the wheels

“The ZR1 has a performance-driven design,” said Bennion. “There is an aesthetic element to all of the unique features, but they were developed first and foremost to support the car’s performance capability.”

Bennion cites the front splitter and rear spoiler as prime examples.

“Because of its top-speed and handling capabilities, the ZR1 requires more downforce than the Z06, and the splitter and rear spoiler were carefully shaped and wind-tunnel tested to meet that requirement,” he said. “The front fenders were widened to cover the wider wheels and their new, twin-outlet vents provide a path for hot air to escape.”

The ZR1 shares the front fascia with the Z06, but the brake-cooling ducts are revised to channel more air to the brakes. Even the front suspension’s A-arms were aerodynamically optimized – they feature air deflectors that direct air to the carbon-ceramic brake rotors.

The ZR1 is available in seven exterior colors, including: Black, Velocity Yellow Tintcoat, Victory Red, Atomic Orange Metallic, Jetstream Blue Metallic Tintcoat and two new colors – Blade Silver Metallic and Cyber Gray Metallic.

Exposed carbon-fiber

A lightweight material pioneered in racing circles, carbon-fiber has an undeniable air of exoticness and only a few production cars have ever employed the relatively expensive composite in their exterior panels. The 2004 Corvette Z06 Commemorative Edition featured a carbon-fiber outer hood and the current Z06 has carbon-fiber fenders and floor panels.

On the ZR1, the roof panel, roof bow, lower rocker moldings, front splitter and the underside of the hood feature exposed-weave carbon-fiber. The other carbon-fiber parts of the ZR1 include the front fenders and hood. The front fascia, doors, rear fenders and rear fascia are made of various other composite materials and all are painted body-color.

The carbon-fiber panels contribute to the car's visual identity – particularly the exposed-weave panels – but they also serve an important purpose: They save weight. The carbon-fiber roof panel and roof bow, for example, weigh about 7.7 pounds (3.5 kg) less than the already lightweight composite panels on the Corvette Z06.

Ironically, the identifiable and intricate weave pattern of carbon-fiber on most production cars is hidden beneath a shell of paint, because the weave is very susceptible to ultra-violet (UV) light damage, which can cause yellowing or a generally dull appearance. But thanks to a specially developed material that ensures a deep, lustrous and long-lasting finish, the '09 ZR1's exposed-weave panels feature a clear coat that protects like paint.

“The clear coat is applied to the exposed carbon-fiber panels that are exposed to sunlight,” said Mark Voss, designing engineer. “In addition to preventing damaging UV rays, the coating has the chip and scratch resistance of conventional paint.”

The special clear coat, which is a proprietary product developed by a GM supplier for the ZR1 program, gives the carbon-fiber parts a shiny, almost wet finish that adds to the visual depth of the weave pattern.

Interior details

The ZR1's interior builds on the brand's dual-cockpit heritage, with high-quality materials, craftsmanship and functionality that support the premium-quality experience promised by the car's performance. The ZR1's cabin differs from the Corvette and Corvette Z06 with the following:

- ZR1-logo sill plates
- ZR1-logo headrest embroidery
- Specific gauge cluster with “ZR1” logo on the tachometer and a 220-mph (370 km/h) readout on the speedometer
- Boost gauge added to the instrument cluster and head-up display

The “base” ZR1 (RPO 1LZ) comes with accoutrements based on the Z06, including lightweight seats and lightweight content. The uplevel interior package includes unique, power-adjustable and leather-trimmed sport seats (embroidered with the ZR1 logo); custom, leather-wrapped interior available in four colors; navigation system, Bluetooth connectivity and more.

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CORVETTE ZR1: IT'S GOOD TO BE THE KING

DETROIT – Few new cars have ever caused the stir that whipped up around the 1990 Corvette ZR-1. It started with fuzzy spy photos and Detroit gossip about a high-powered, “King of the Hill” model. Chevrolet was coy, neither confirming nor denying the grist of the rumor mill.

Rumor became fact at the 1989 Geneva Auto Show, when the ZR-1 officially debuted. It was a time when performance cars were only beginning to regain some of the performance enjoyed during the heyday of the muscle car, and the ZR-1's 375-horsepower (280 kW) LT5 V-8 engine – with its DOHC configuration and four-valve heads – was an intoxicating breath of high-octane excitement.

The all-aluminum LT5 engine's design was a collaboration of GM and Lotus Engineering, sharing only a 5.7-liter displacement with other small-block engines. The engine was built by Mercury Marine, which was renowned for its aluminum machining capability. Engineers were justifiably proud of the LT5's refinement and smoothness; so much so that it was claimed a nickel placed on its end on top of the engine wouldn't fall over when the engine was started. The challenge was immediately taken up – and the LT5 roared to life while the nickel remained standing.

The ZR-1 was more than merely a more powerful Corvette – it was a complete performance package that included wider rear bodywork to accommodate humongous rear tires and a unique, convex rear fascia with rectangular taillamps that made the car recognizable at a glance. The distinctive exterior elements contributed to the car's mythical status among enthusiasts and auto critics. At its launch, the ZR-1 was found on the cover of just about every automotive publication around the globe, with Car and Driver dubbing it the “Corvette from Hell.”

Proving the ZR-1's performance lived up to its instant legend status, a production model was sent to a high-speed test track at Fort Stockton, Texas, and set seven world speed records – the most notable being a 24-hour endurance run that averaged 175.8 mph (283 km/h) and recorded more than 4,200 miles.

During 1990, the premium ZR-1 recorded 3,044 sales. Subsequent model years didn't quite match the buzz created by that first year, even with a horsepower increase to 405 (302 kW) in 1993. This was due partly to all Corvette models from 1991 through 1995 – the ZR-1's 1995 final year – wearing convex rear fascias that made them almost indistinguishable from the higher-performance “King of the Hill” models. Total production of the 1990–95 ZR-1 was 6,939.

The new king

With features such as unique , exposed carbon-fiber body panels, a raised hood with a window to the LS9 engine and massive 19-inch front and 20-inch rear wheels, there's little chance the new ZR1 will be mistaken for any other model. It also wears distinguishing blue accents, including the engine cover visible through the hood window, the brake calipers and the rear fascia badge – the only rear fascia badge affixed to current-generation Corvettes.

Nineteen years after its initial release, a new ZR1 is set to reclaim the title as the king. Interestingly, the standard 2008 Corvette has more horsepower than the 1990 ZR-1, but the new ZR1's approximate 620 horses is 45 percent more than the base model's 430 rating. That's roughly the same advantage the LT5 carried over the standard 1990 Corvette's 250-horsepower engine.

By the way, historians and detail-minded enthusiasts will note the '09 ZR1 is spelled without the hyphen that designated the 1990–95 ZR-1. This is because GM has changed its naming convention and the un-hyphenated “ZR1” corresponds with the current rule for alphanumeric designations.

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2009 CORVETTE ZR1 POWERED BY THE MOST POWERFUL PRODUCTION ENGINE EVER FROM GM: THE SUPERCHARGED LS9 SMALL-BLOCK V-8

PONTIAC, Mich. – When it arrives next summer, the 2009 Chevrolet Corvette ZR1 will be the most powerful and fastest production car ever produced by General Motors, with performance enabled by a new, supercharged 6.2L LS9 small-block V-8 engine.

Incorporating the engineering experience already found in the Corvette Z06's LS7 engine and the new-for-2008 6.2L LS3 of the Corvette, GM Powertrain is targeting 100 horsepower per liter for the LS9, or 620 horsepower (462 kW), and approximately 595 lb.-ft. of torque (807 Nm); final SAE-certified power levels will be available in early March 2008.

It is, indeed, the ultimate small-block engine for the ultimate Corvette.

"When you experience the LS9 in the Corvette ZR1, the terms performance and refinement take on a new meaning," said Tom Stephens, group vice president for GM Powertrain and Quality. "The LS9 demonstrates an outstanding performance range, with smooth driveability at low speeds, and surprisingly fierce performance when the customer wants more power."

The enabler of the LS9's performance is a new, large positive-displacement Roots-type supercharger – with a unique four-lobe design – developed for the engine by Eaton. It is teamed with an integrated charge cooling system that reduces inlet air temperature for maximum performance. The LS9 represents the first of several new, supercharged small-block engines that will be introduced in GM vehicles in the near future, each using superchargers of similar design.

"The small-block V-8 once again demonstrates its boundless horsepower potential, versatile design and an architecture with proven quality, durability and reliability," said Stephens. "We haven't yet realized the small-block's performance potential."

Performance range

More than just its tremendous peak horsepower and torque numbers, the supercharged LS9 makes big power at lower rpm and carries it in a wide arc to 6,600 rpm. GM Powertrain testing shows the engine makes approximately 300 horsepower (224 kW) at 3,000 rpm and nearly 320 lb.-ft. of torque (434 Nm) at only 1,000 rpm. Torque tops 585 lb.-ft. (793 Nm) at about the 4,000-rpm mark, while horsepower peaks at 6,500 rpm. The engine produces 90 percent of peak torque from 2,600 rpm to 6,000 rpm.

Heavy-duty and lightweight reciprocating components enable the engine's confident high-rpm performance, while the large-displacement Eaton supercharger pushes

enough air to help the engine maintain power through the upper levels of the rpm band.

“The sixth-generation design of the supercharger expands the ‘sweet zone’ of the compressor’s effectiveness, broadening it to help make power lower in the rpm band,” said Ron Meegan, assistant chief engineer. “To put it simply, the low-end torque is amazing.”

The LS9 is assembled by hand at GM’s Performance Build Center, a unique, small-volume engine production facility in Wixom, Mich., that also builds the Corvette Z06’s LS7 engine and other high-performance GM production engines.

Cylinder block and reciprocating assembly details

The LS9’s aluminum cylinder block features steel, six-bolt main bearing caps, with enlarged vent windows in the second and third bulkheads for enhanced bay to bay breathing. Cast iron cylinder liners – measuring 4.06 inches (103.25 mm) in bore diameter – are inserted in the aluminum block and they are finish-bored and honed with a deck plate installed. The deck plate simulates the pressure and minute dimensional variances applied to the block when the cylinder heads are installed, ensuring a higher degree of accuracy that promotes maximum cylinder head sealing, piston ring fit and overall engine performance.

Nestled inside the cylinder block is a forged steel crankshaft that delivers the LS9’s 3.62-inch (92 mm) stroke. It features a smaller-diameter ignition-triggering reluctor wheel and a nine-bolt flange – the outer face of the crankshaft on which the flywheel is mounted – that provides more clamping strength. Other non-supercharged 6.2L engines, such as the base Corvette’s LS3, have a six-bolt flange. A torsional damper mounted to the front of the crankshaft features a keyway and friction washer, which also is designed to support the engine’s high loads.

Attached to the crankshaft is a set of titanium connecting rods and forged aluminum pistons, which, when combined with the cylinder heads, delivers a 9.1:1 compression ratio. This combination is extremely durable and lightweight, enabling the LS9’s high-rpm capability.

Cylinder head details

The basic cylinder head design of the LS9 is similar to the L92-type head found on the LS3 V-8, but it is cast with a premium A356T6 alloy that is better at handling the heat generated by the supercharged engine – particularly in the bridge area of the cylinder head, between the intake and exhaust valves.

In addition to the special aluminum alloy, each head is created with a rotocast method. Also known as spin casting, the process involves pouring the molten alloy into a rotating mold. This makes for more even distribution of the material and virtually eliminates porosity – air bubbles or pockets trapped in the casting – for a stronger finished product.

Although the heads are based on the L92 design, they feature swirl-inducing wings that are cast into the intake ports. This improves the mixture motion of the pressurized air/fuel charge. The charge enters the combustion chambers via titanium intake valves that measure 2.16 inches (55 mm) in diameter. Spent gases exit the chambers through 1.59-inch (40.4 mm) hollow stem sodium-filled exhaust valves. The titanium intake and sodium-filled exhaust valves are used for their lightweight and high-rpm capability.

To ensure sealing of the pressurized engine, unique, four-layer steel head gaskets are used with the LS9's heads.

Camshaft and valvetrain

The broad power band enabled by the LS9's large-displacement supercharger allows it to make strong low-end torque and great high-rpm horsepower, which allowed engineers to specify a camshaft with a relatively low lift of 0.555-inch (14.1 mm) for both the intake and exhaust valves. This low-overlap cam has lower lift and slower valve-closing speeds than the Z06's 505-horsepower (377 kW) LS7, helping the LS9 – with its approximately 620 horsepower – deliver exemplary idle and low-speed driving qualities.

The camshaft actuates a valvetrain that includes many components, including the lifters, rocker arms and valve springs, of the LS3 engine. However, LS7 retainers are used to support the engine's high-rpm performance.

Supercharger and charge cooler details

The LS9's R2300 supercharger is a sixth-generation design from Eaton, with a case that is specific to the Corvette application. The supercharger features a new four-lobe rotor design that promotes quieter and more efficient performance, while its large, 2.3-liter displacement ensures adequate air volume at high rpm to support the engine's high-horsepower aspiration. Maximum boost pressure is 10.5 psi (0.72 bar).

The supercharger is an engine-driven air pump that contains a pair of long rotors that are twisted somewhat like pretzel sticks. As they spin around each other, incoming air is squeezed between the rotors and pushed under pressure into the engine – forcing more air into the engine than it could draw under “natural” aspiration. The rotors are driven by a pulley and belt that are connected to the engine's accessory drive system.

Because the pressurized air is hotter than naturally aspirated air, the LS9 employs a liquid-to-air charge cooling system to reduce inlet air temperature after it exits the supercharger – reducing the inlet air temperature by up to 60 degrees C (140 F). Cooler air is denser and allows the engine to make the most of its high-pressure air charge. The charge cooling system includes a dedicated coolant circuit with a remote-mounted pump and reservoir.

The design of the supercharger case and its integrated charge cooling system was driven by the space and dimensions afforded under the Corvette's hood. To that end, the charge cooler was designed as a “dual brick” system, with a pair of low-profile heat exchangers mounted longitudinally on either side of the supercharger. Coupled with the supercharger itself, this integrated design mounts to the engine in place of a conventional intake manifold and is only slightly taller than a non-supercharged 6.2L engine. The air inlet and rotor drive pulley are positioned at the front of the supercharger.

Additional engine details

Oiling system: The LS9 uses a dry-sump oiling system that is similar in design to the LS7's system, but features a higher-capacity pump to ensure adequate oil pressure at the higher cornering loads the ZR1 is capable of achieving. An oil-pan mounted oil cooler is integrated, too, along with piston-cooling oil squirters located in the cylinder block. The expanded performance envelope of the Corvette ZR1 required changes to the dry sump system also used in the Z06. System capacity is increased and scavenge

performance improved to meet the demands of Chevrolet's highest-performance sports car.

Water pump: To compensate for the heavier load generated by the supercharger drive system, an LS9-specific water pump with increased bearing capacity is used.

Accessory drive system: To package the accessory drive system in the Corvette's engine compartment, the supercharger drive was integrated into the main drive system. This required a wider 11-rib accessory drive system to be used with the LS9 in order to support the load delivered by the supercharger.

Fuel system: The LS9 uses high-capacity 48-lb./hr. fuel injectors with center-feed fuel lines. The center feed system ensures even fuel flow between the cylinders with less noise. In order to ensure fuel system performance during low speed operation as well as under the extreme performance requirements of wide open throttle (WOT), a dual pressure fuel system was developed. This system operates at 250 kPa at idle and low speed, and ratchets up to 600 kPa at higher-speed and WOT conditions.

Throttle body: An 87-mm, single-bore throttle body is used to draw air into the engine. It is electronically controlled.

Rocker covers / ignition coils: Unique rocker covers with new, direct-mount ignition coils are used. Other Gen IV engines, such as the LS3, feature coil packs mounted to a bracket. The LS9's direct-mounted coils offer a cleaner appearance and a shorter lead between the coil and spark plug.

Beauty cover: A special engine cover is attached to the top of the LS9. It surrounds the intercooler, which is visible through a hood window. The intercooler has the legend "LS9 SUPERCHARGED" embossed on the left and right sides, and the engine beauty cover features the Corvette crossed flags logo debossed at the front.

New six-speed manual transmission

The Corvette ZR1's LS9 engine is backed by a Tremec TR6060 six-speed manual transmission, with a twin-disc clutch system. It is based on the new-for-2008 TR6060 six-speed, but upgraded to handle the LS9's torque output and delivers improved shift quality.

The twin-disc clutch system provides exceptional clamping power, while maintaining an easy clutch effort. The system employs a pair of 260-mm discs, which spreads out the engine's torque load over a wider area, enabling tremendous clamping power to channel the LS9's torque. It also dissipates heat better and extends the clutch life (in normal driving).

Thanks to comparatively small plates, the twin-disc system enables similar disc inertia to the Corvette Z06, which has a 290-mm single-disc system, contributing to low shift effort and providing exceptionally smooth engagement and light pedal effort. In fact, the more powerful ZR1 has a pedal effort similar to the Z06.

ZR1-specific gearing in the transmission provides a steep first-gear ratio that helps launch the car. The car's top speed is achieved in sixth gear – a change from the fifth-gear top-speed run-outs in the manual transmission Corvette and Corvette Z06. The gears also are designed to balance performance with refinement. The angles of the gear teeth are optimized to provide both strength and quietness.

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For release: Dec. 20, 2007, 12:01 a.m. EST

2009 CORVETTE ZR1 PRELIMINARY SPECIFICATIONS

Overview	
Model:	2009 Chevrolet Corvette ZR1
Body styles / driveline:	2-door hatchback coupe with fixed roof; rear-wheel drive
Construction:	composite and carbon-fiber body panels, hydroformed aluminum frame with aluminum and magnesium structural and chassis components
Manufacturing location:	Bowling Green, Ky.

Engine	6.2L SUPERCHARGED V-8 (LS9)
Displacement (cu in / cc):	376 / 6162

Bore & stroke (in / mm):	4.06 x 3.62 / 103.25 x 92
Block material:	cast aluminum
Cylinder head material:	cast aluminum
Valvetrain:	overhead valve, 2 valves per cylinder
Fuel delivery:	SFI (sequential fuel injection)
Compression ratio:	9.1:1
Horsepower / kW:	620 / 462 (est.)
Torque (lb-ft / Nm):	595 / 823 (est.)
Recommended fuel:	premium required
EPA estimated fuel economy:	TBD

Transmission	close-ratio six-speed manual
Application:	std
Gear ratios (:1):	
First:	2.29
Second:	1.61
Third:	1.21
Fourth:	1.00
Fifth:	0.81
Sixth:	0.67
Reverse:	3.11
Final drive ratio:	3.42

Chassis / Suspension	
Front:	short/long arm (SLA) double wishbone, cast aluminum upper & lower control arms,

	transverse-mounted composite leaf spring, monotube shock absorber
Rear:	short/long arm (SLA) double wishbone, cast aluminum upper & lower control arms, transverse-mounted composite leaf spring, monotube shock absorber
Traction control:	electronic traction control; active handling (Magnetic Selective Ride Control)

Brakes	
Type:	front and rear power-assisted carbon-ceramic disc with 6-piston front and 4-piston rear calipers, cross-drilled rotors; ABS std.
Rotor diameter (in / mm):	front: 15.5 / 394 rear: 15 / 380
Wheels & Tires	
Wheel size:	front: 19-inch x 10-inch rear: 20-inch x 12-inch
Tires:	Michelin Pilot Sport 2 front: P285/30ZR19 rear: P335/25ZR20

Dimensions	
Wheelbase (in / mm):	105.7 / 2685
Overall length (in / mm):	176.2 / 4476
Overall width (in / mm):	75.9 / 1928
Overall height (in / mm):	49 / 1244
Curb weight (lb / kg):	3350 / 1519 (est.)

Interior	
Seating capacity	2
Interior volume (cu ft / L):	52 / 1475 (all models)
Headroom (in / mm):	38 / 962 (all models)
Legroom (in / mm):	43 / 1092 (all models)
Shoulder room (in / mm):	55 / 1397 (all models)
Hip room (in / mm):	54 / 1371 (all models)
Capacities	
Cargo volume (cu ft / L):	22 / 634
Fuel tank (gal / L):	18 / 68.1
Engine oil (qt / L):	12.5 / 11.8

Note: Information shown is current at time of publication.