GREAT CORVETTE POWERTRAINS

The allure of a two-seat sports car is undeniable, but the true test of an automotive icon is its performance. The sensuous sweep of a fiberglass fender or the glint of polished chrome can charm the eye momentarily, but the irresistible force of a roaring V-8 engine makes an indelible impression.

Almost from its conception, Corvette has been a showcase for engine development. Guided by the inspired hand of Zora Arkus-Duntov, Corvette earned a reputation for technical innovations – a tradition that has endured through five generations of remarkable machines.

Chevrolet rocked the automotive world in 1955 with the introduction of the 265 cubic inch small-block V-8. It was simply a brilliant design: lightweight, compact and powerful. Under the supervision of Chevrolet Chief Engineer Ed Cole, GM engineers created a modern masterpiece. The venerable inline six-cylinder engine that had powered Corvette in its infancy was quickly overshadowed.

The introduction of the small-block V-8 marked the beginning of the modern era of performance. There were other engines with eight cylinders, and other motors with overhead valves, but none with the performance potential of GM's startling new design. Total production of GM small-block-based engines is approaching 90 million units, and they won more races and championships than any other production engine.

The first small-block V-8 introduced concepts that were considered revolutionary at the time: thin-wall cylinder block castings; interchangeable heads; stamped steel rocker arms with spherical pivots; short exhaust ports to minimize heat transfer to the coolant; slipper-skirt pistons; an intake manifold that sealed the lifter valley; and overhead oiling through hollow pushrods. These technical features may seem commonplace today, but they were cutting-edge in the '50s.

While standard 265-ci passenger car engines produced a respectable 162 gross horsepower, Corvette versions raised the ante to 195 hp. The catalog of factory high-performance parts expanded exponentially as high-rise intake manifolds, free-breathing cylinder heads and heavy-duty components were developed for the demands of racing – parts that could be purchased by racers and hot rodders at any Chevrolet dealership.

The Corvette was the ideal platform for demonstrating the small-block's prowess. The arrival of Ramjet mechanical fuel injection in 1957 made it possible for Corvette's 283-ci small-block to produce an amazing one horsepower per cubic inch. Special valve springs and camshaft designs raised the small-block's redline to new heights. The unmistakable sound of a solid-lifter Duntov cam commanded instant respect at both race tracks and drive-ins.

The 283 ci small-block reached its zenith in 1961 when a 315-hp version debuted. Although plans to produce aluminum cylinder heads were eventually shelved, the lightweight heads' enlarged ports were incorporated in cast-iron versions that further raised the small-block's output.

Advances in casting techniques allowed Chevrolet to enlarge the small-block's cylinder bore diameter to 4.00 inches in 1962. These bigger bores were combined with a new 3.250-inch stroke crankshaft to create a 327-ci small-block. The additional displacement boosted Corvette's top-of-the-line small-block to 360 hp.

With second-generation Rochester fuel injection, larger 2.02-inch diameter intake valves and an aggressive new camshaft profile, the 1964 L84 produced 375 gross horsepower in factory trim. A Holley four-barrel carburetor appeared on a factory small-block for the first time, producing only 10 less horsepower than the fuel-injected version.

Duntov's high-performance team developed intriguing variations on the small-block theme, experimenting with both hemispherical cylinder heads and overhead cams. A 327-ci prototype with single overhead cam heads produced 509 hp, and a 377-ci pushrod hemi produced 532 hp. None of Duntov's exotic small-blocks reached production, but they stoked the fires of performance at Chevrolet R&D.

The high-performance L79 327-ci small-block debuted to rave reviews in 1964. With its radical hydraulic lifter cam and Holley four-barrel, this powerhouse delivered real-world performance that far exceeded its modest 350 hp rating.

Development of the first-generation small-block reached its peak with the release of the 370-hp/350-ci LT1 in 1970. The LT1 was a compilation of Chevy's best heavy-duty parts: a hot mechanical lifter camshaft, forged aluminum pistons that yielded an 11:1 compression ratio, a Holley four-barrel on a high-rise aluminum intake, and high-performance cylinder heads.

As the freewheeling '50s and swinging '60s gave way to the socially conscious '70s, concerns about emissions and fuel economy impacted the small-block. Engines sprouted an alphabet soup of emission controls: EGR (exhaust gas recirculation), AIR (air injection reaction), ESC (electronic spark control), EVAP and many others. Catalytic converters and unleaded fuel became obligatory. Horsepower ratings declined dramatically in 1971 with the switch to unleaded fuel and the adoption of net (rather than gross) power ratings. The emission-controlled small-block became a model citizen.

Corvette continued to showcase the most potent small-blocks that could be found in a Chevrolet showroom. During the days of energy crises and gasoline rationing, Corvette engineers kept the flame of performance alive with the L82 small-block. In spite of falling compression ratios and stringent government regulations, Corvette still had enough performance to pace the 1978 Indianapolis 500 in pure production trim.

America's favorite performance engine continued to evolve through the Digital Decades. The development of sophisticated electronic controls gave GM engineers the means to make the small-block V-8 simultaneously economical, environmentally responsible and powerful. The L83 Corvette engine debuted with Cross-Fire fuel injection in 1982. This induction system featured twin throttle bodies on a cross-ram intake manifold – a design reminiscent of the Trans-Am racing engines of the '60s.

Chevy's 230 hp L98 small-block with tuned-port fuel injection debuted in the 1985 Corvette. The L98's multi-point fuel injection system looked as sensational as it performed. The TPI system featured eight individual injectors, tuned runners, and a mass airflow sensor to enhance performance. More powerful on-board computers integrated the engine with the transmission and chassis to provide a seamless driving experience. Aluminum cylinder heads were introduced on selected Corvette engines in 1986, and in 1987 low-friction hydraulic roller camshafts debuted.

The small-block received its first major facelift in 37 years with the introduction of the second-generation LT1 in 1992. The LT1 retained the small-block's classic architecture, but added a level of refinement that raised the little Chevy to world-class standards.

The second-generation LT1 was shorter and lower than its predecessor to fit under fashionably low hood lines. Its list of refinements included an innovative reverse-flow cooling system, a front-mounted optical distributor, a gear-drive water pump and a short-runner fuel injection manifold. The proof was in the LT1's performance: with 300 hp on hand, the base Corvette became the worst nightmare of rival supercar owners. In 1996, the high-output LT4 version raised the bar even higher with a 330-hp rating and a breathtaking 6,300 rpm redline.

For a magical moment in time, Corvette was also available with big-block Chevrolet power. The big-block Chevrolet raised the performance of Chevy's sports car to withering heights.

The Chevrolet big-block V-8 was the direct descendant of the fabled Mark II "Mystery Motor" that powered a handful of very fast Chevrolet stock cars at the 1963 Daytona 500. The mystery concealed by the engine's wide, flat rocker covers was a closely guarded secret, however.

When Chevrolet released the engine to the public two years later, it had been reworked, refined and rechristened as the Mark IV. The secret of the big-block V-8's prodigious horsepower was also revealed: its valves were angled in two planes. These compound angles unshrouded the valves at high lift and opened a new path to improved performance.

The new 396-ci big-block V-8 created a sensation in 1965. The first Mark IV motor had 4.094-inch cylinder bores, a 3.76-inch stroke crankshaft and a 425-hp rating. In 1966, Chevy enlarged the cylinder bores to 4.25-inches in diameter; although the legendary 427-ci big-block had 31 more cubic inches than its 396-ci sibling, it was rated at a conservative 390 hp in "mild" configuration and 425 hp in the "wild" version. Crowned by a trio of two-barrel carburetors, the 1967-69 427-ci L71 Corvette engine was uprated to 435 hp.

The big-block Chevy was already the lightest super high-performance engine being built in the late '60s, but Chevrolet engineers played their trump card with an all-aluminum version in 1969. The featherweight ZL-1 block tipped the scales at a scant 98 pounds – less than half the weight of its cast-iron counterparts. The ZL-1 had cylinder liners, provisions for dry-sump oiling and a hefty price tag. Two of these all-aluminum 430-hp big-blocks were installed in Corvettes, making them highly prized collector cars.

Chevy unleashed the Corvette's biggest gun in 1970 by increasing the 427's crankshaft stroke to 4.00 inches. The new top-of-the-line 454-ci big-block was modestly pegged at 425 hp. But the times were changing, and so was Corvette. Ten years after it began, the big-block era ended in 1974 with the 454-ci/270-hp LS4.

According to a familiar hot rodding maxim, there's no substitute for cubic inches. But Chevrolet did find a replacement for displacement in 1990: technology. The Corvette ZR-1 option package featured an all-aluminum, 32-valve 5.7-liter V-8 LT5 engine that produced 375 hp at 5,800 rpm. This exotic engine had dual overhead camshafts and a dual-power mode that allowed the driver to limit its prodigious power output with a valet key. In 1993, improvements in breathing added 30 more horsepower, increasing the LT5's output to 405 hp. The final production year for the legendary ZR-1 was in 1995.

When the fifth-generation Corvette debuted in 1997, it introduced an all-new small-block for the 21st century – the LS1. The LS1 retained the small-block's longstanding virtues of compact size, simplicity and high specific output, yet it used virtually none of the familiar components.

Like the LT1 engine that had been the primary Corvette powerplant since 1992, the LS1 displaced 5.7 liters and retained the small-block V-8's customary 4.40-inch cylinder bore spacing. But almost everything else was different: the block was aluminum instead of cast iron. The cylinder bore diameter was smaller (3.90 inches), the crankshaft stroke longer (3.62 inches) and the horsepower rating higher (340 hp at 5,600 rpm). The production LS1 engine provided a strong foundation for the championship-winning Corvette C5-R racing program.

The LS1 aluminum block featured a deep-skirt design, with oil pan rails that extended below the crankshaft centerline to improve stiffness and rigidity. The five main bearing caps were secured by six fasteners – four vertical bolts that screw into the main bearing bulkheads and two additional cross-bolts that anchor the caps to the sides of the block. The cross-bolted main caps and deep-skirted crankcase curtailed block distortion and bending under high loads, reducing noise and vibration.

The small-block's traditional five-bolt pentagonal head bolt pattern around each cylinder bore was replaced by four equally spaced bolts in the LS1. This four-bolt pattern reduced bore distortion and permitted the use of low-tension piston rings that cut friction and enhanced fuel economy.

The LS1's shallow 15-degree valve angle and compact combustion chambers produced a 10:1 compression ratio with flat-top pistons. By eliminating an obtrusive piston dome and valve reliefs, flame travel in the combustion chambers was improved and emissions reduced.

The small-block's traditional siamesed cylinder head runners were replaced in the LS1 by evenly spaced, symmetrical intake and exhaust ports. Lightweight valve spring retainers, beehive-shaped springs and cast-steel roller rocker arms provided a stable valvetrain that enhanced the LS1's performance at high rpm.

The lightweight composite LS1 intake manifold's smooth interior passages promoted high-speed airflow and insulated the intake charge from engine heat. The tuned intake runners and sophisticated sequential fuel injection system produced a wide, flat power curve.

Small-block engine development reached its zenith in the 2006 Corvette Z06 that is powered by a 7-liter (427-ci) LS7 engine that produces 505 horsepower. The LS7 honors Corvette's performance heritage by reviving the designation that identified the brawny 454-ci/460-hp big-block V-8 that was scheduled to be available in 1970 but was discontinued before production.

The LS series of small-block V-8 engines marked a departure from the small-blocks of the past, but it affirmed GM's advanced overhead valve engine technology as a powerful resource for America's world-class sports car. The LS7 is the heir to Corvette's heritage of great engines that has stirred the souls of enthusiasts for more than 50 years.

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