PSM requires an electronic throttle ("drive-by-wire") because it may need to reduce power – not just apply selective braking – to help restore stability. PSM reduces power first by adjusting ignition timing and then, if necessary, fuel flow.

The PSM system operates so quickly that most drivers likely will not feel it making corrections. The driver can disengage PSM with a dashboard switch. However, for safety, PSM will engage during braking and then disengage when the driver lifts off the brake.

A warning lamp on the instrument panel indicates PSM operation. While confident in the system's ability as a dynamic handling aid, Porsche cautions drivers that PSM cannot counteract the laws of physics, such as gravity and available friction. The driver should heed the light and adjust his/her driving technique. The Porsche Boxster applies a racecar-derived "staggered" wheel and tire arrangement – wider wheels with wider, lower-profile tires on the rear. The standard aluminum alloy wheels measure 16 x 6 inches in front and mount 205/55 ZR16 tires; the 16 x 7-inch rear wheels mount 225/50 ZR16 tires.

Performance

An optional 17-inch wheel/tire package features 17 x 6 inch wheels with 205/50 ZR17 tires in front and 17 x 8.5 inch wheels with 255/40 ZR17 tires in the rear. An additional option package includes 18 x 7.5 inch wheels with 225/40 ZR18 tires in front and 18 x 9 inch wheels with 265/35 ZR18 tires in the rear. Powered by a 2.7-liter, 217-horsepower horizontally opposed six-cylinder engine, the Porsche Boxster can accelerate from 0-60 mph in just 6.4 seconds (0-100 km/h in 6.6 sec.) and reach a top speed of 155 mph (250 km/h) on the test track. The 2.7-liter engine replaced a 201-horsepower 2.5-liter version that powered the 1998-1999 Boxster models. The larger displacement engine features a twin-resonance induction system – similar to that in the 911 – that helps boost horsepower and torque. An E-Gas electronic "drive-by-wire" throttle control provides more precise throttle control than mechanical linkage for improved response and lower emissions.

The 2.7-liter Boxster engine produces 192 lb.-ft. of peak torque at 4,500 rpm, with a significant 147 lb.-ft. of torque available as early as 1,750 rpm. The engine sustains peak torque from 4,200 rpm to nearly 6,000 rpm, providing quicker response than "peaky" smaller-displacement engines. The driver experiences this torque performance through instant engine response in any gear. Engineers refer to this aspect of performance as an engine's flexibility – its ability to respond to throttle input at various loads and speeds. They measure flexibility by acceleration in top-gear (no downshifting). The Boxster accelerates from 50 mph (80 km/h) to 75 mph (120 km/h) in top gear in 10.4 seconds – a full second quicker than the previous 2.5-liter model.

Boxer

The arrival of the Boxster to the U.S. market in model-year 1998 ushered in a new era for Porsche engine design. While the classic horizontally opposed "boxer" layout owes its heritage to the very first Porsche, liquid cooling replaced air-cooling for Porsche standard-production road cars after nearly five decades. Consequently, the greater efficiency of liquid cooling allowed Porsche to use four-valves-per cylinder in place of two valves per-cylinder in the air-cooled engines. The "boxer" name for this engine layout comes from the motion of the rods and pistons, which resembles opposing boxers throwing punches. Horizontally opposed engines are also known as "flat" engines, because their cylinders lie in a flat plane. Benefits of the boxer layout include compact packaging and low inherent vibration. In addition, a boxer engine contributes to a low center of gravity, since the layout concentrates most of the engine's mass at a low point in the vehicle. The Boxster engine shares only its horizontally opposed layout with previous Porsche boxer engines. Porsche introduced new engine architecture and new construction techniques with the Boxster engine.

The Boxster engine features a two-piece (vertically split) aluminum block (crankcase). The block holds the two-piece (also vertically split) aluminum bearing case, which feature nodular cast iron bearing shells. This construction technique reduces bearing clearance changes caused by temperature fluctuations, which in turn reduces noise. Oil spray jets inserted into the bearing case provide additional piston cooling.

Multi-piece engine construction allows Porsche to cast oil and coolant passages into the block rather than drill them in later. That simplifies engine construction and reduces the chances of debris getting into the engine. The cylinders feature innovative wear-reducing technology called LOKASIL. The process casts sleeves made from 25 percent silicon/75 percent air directly into the cylinders. During block casting, the air escapes, leaving the silicon "locally" along its path – hence the name, LOKASIL. A chemical etching process then exposes the silicon in the sleeves. The drop-forged crankshaft rides in seven main bearings and features 12 counterweights. Porsche laser-scores and then cracks the connecting rods after forging, creating perfectly matched halves. Porsche has long featured race-proven "dry sump" oil systems. In past engines, Porsche used a separate, remote oil tank. The Boxster engine features an integrated dry-sump system – the sump sits inside the block, next to the crankshaft. A return oil pump in each cylinder head (oil cannot fall back into the sump from the cylinder heads in a boxer engine) routes the oil through two separators, which centrifuge the oil to defoam it and remove combustion gases. Doing so ensures oil consistency for optimal performance, emissions and durability.

Oil Changes

The Boxster engine holds 8.7 quarts (8.2 liters) of oil, and the Porsche Boxster engine can go a remarkable 15,000 miles (24,000 km) between oil changes and 30,000 miles (48,000 km) between oil filter changes. The coolant system includes an oil cooler. During engine warm-up, the engine coolant helps heat the oil to bring the engine up to operating temperature quickly. When the engine oil reaches 200 degrees Fahrenheit (93 degrees Celsius), the oil cooler dissipates heat to the engine coolant. Three-piece aluminum

cylinder heads include the actual head, camshaft housing and a cover. As with the cylinder block, multi-piece construction allows casting coolant and oil passages into the heads, eliminating the need to drill them after manufacturing. Making the left and right cylinder heads identical (and therefore interchangeable) reduces manufacturing complexity and cost.

Camshaft timing

Chain-driven double overhead camshafts – hollow-cast for lower reciprocating weight – actuate four valves per cylinder via bucket-type tappets. Automatic chain tensioners and hydraulic valve lash compensation reduce maintenance. The Boxster engine employs the Porsche-patented VarioCam® system, which boosts low-end and mid-range torque by varying valve overlap at different engine speeds. Valve overlap – the fraction of a second at the end of the engine's exhaust stroke and beginning of the intake stroke when all valves are open – directly affects torque and emissions. "Early" valve timing – when the intake valves open and close sooner – creates greater valve overlap, which enhances cylinder filling and boosts torque. "Late" valve timing closes the intake valves later in the stroke, which draws in more air to boost power. Late valve timing also reduces exhaust hydrocarbon emissions at idle and low engine speeds.

In the past, engineers had to set camshaft timing (and thus valve overlap) as a compromise, sometimes sacrificing low-end torque for high-end horsepower, or vice versa. Porsche introduced the VarioCam system in the early 1990s to vary valve overlap, enhancing torque output without reducing high-end power.

In operation, the engine control unit operates timing pistons in the intake camshaft chain tensioners. When the engine reaches 1,200 rpm, the control unit signals the piston to rotate the intake camshafts by 12.5 degrees. When the engine reaches 5,120 rpm, the pistons return the camshafts to their normal positions. (The control unit will delay VarioCam until 1,480 rpm if the engine oil temperature exceeds 266 degrees Fahrenheit.) The Porsche VarioCam system requires fewer parts than variable valve timing systems in other automaker's models. The Boxster inherits its twin-resonance air induction system from the 911 Carrera. The system acts as a "resonance supercharger," allowing the engine to draw from higher velocity airflow at certain engine speeds. A crossover pipe connects the individual air collector/resonance chambers for each cylinder bank. A flap in the pipe remains closed from idle to about 3,100 rpm. When it opens, each cylinder bank can draw from airflow "excited" by the resonance created by alternating induction between all six cylinders. In essence, "dual resonance" creates two induction paths for each cylinder. Below 3,000 rpm, the cylinders draw air from a "short" path. From 3,000 rpm to about 5,100 rpm – when the resonance flap opens – the cylinders draw from a long intake path, which boosts torque. Above 5,100 rpm, the flap again closes to allow the cylinders to draw intake air from a shorter intake path to boost horsepower at higher engine speeds.

Gas pedal

The Motronic ME 7.2 engine control unit, which Porsche added in model-year 2000, essentially duplicates the functions of the ME 5.2 unit, but with the significant addition of

the E-Gas electronic throttle control. Instead of the gas pedal pulling a cable attached to the throttle valve, it pulls a short cable connected to a pedal value transmitter in the dashboard. The transmitter uses a potentiometer to convert the pedal travel path and speed into an electronic signal.

The control module processes the signal, sending it to an electric motor that operates the throttle valve. By providing full computer control over air intake at all engine speeds, the electronic throttle control enhances throttle response and helps reduce emissions. The system also reduces parts, since it eliminates the throttle linkage and separate idle speed control.

The ME 7.2 engine control unit also controls:
• Sequential multipoint fuel injection (fuel injected according to firing order) with separate fuel mixture control for each cylinder bank.
• Coil-on-plug ignition system. Each cylinder features its own ignition coil mounted directly on a sparkplug, and sparkplug service interval extends to 100,000 miles (161,000 km).
• Adaptive knock control. When a knock sensor detects detonation, the ECU can retard ignition timing for individual cylinders until the condition stops.
• Torque manipulation for the optional Porsche Stability Management system.
• Torque reduction for Tiptronic shifting. (The ECU will slightly reduce torque between gearshifts to ensure smooth operation.)
• VarioCam operation.
• Twin-resonance air induction.

Headers
A separate exhaust system for each cylinder bank feeds into two catalytic converters, which feature a tri-metal (Platinum, Palladium and Rhodium) substrate coating for improved emission reduction. From the converters, the exhaust gases flow into a single large muffler and exit through a central tailpipe, which emits a characteristic Porsche exhaust note.

Manual transmission
The Porsche Boxster comes equipped with a precise-shifting, fully synchronized (including reverse) five-speed manual transmission. To match the torque characteristics of the larger, more powerful engine, Porsche slightly lowered the fourth and fifth and slightly raised the final drive ratio in the manual transmission. Gear ratios in the optional Tiptronic S automatic transmission remain the same as before.

The five-speed manual transmission features a dual-mass flywheel and a cable-actuated shift lever to reduce vibration and noise. Because the shift pattern puts reverse directly below fifth, the transmission includes a reverse lock to prevent shifting from fifth to reverse.

Automatic transmission
Many driving enthusiasts have long proclaimed a manual transmission to be the “proper”

transmission for a sport scar. Automatics, they felt, did not allow the driver to make best use of an engine's speed range and torque. Nor could an automatic provide real driver involvement, essential to the sport scar driving experience. However, with the optional Tiptronic S five-speed automatic transmission, even diehard stick shift drivers may experience greater driving pleasure than they'd ever expect from an automatic. With the Tiptronic S transmission, the floor shifter includes positions for P (Park), R (Reverse), N (Neutral), D (Drive) and, to the left of D, M (Manual). When shifted into D, the transmission offers full automatic operation of the five gears, yet with greater intelligence and sophistication than traditional automatic transmissions. For example, Tiptronic S can downshift when the driver brakes into a corner.

In manual mode, this innovative transmission allows the driver to shift via racecar-inspired steering wheel controls. In automatic mode, the Tiptronic S transmission offers five different shift "maps" or programs. Leisurely driving will call up a map that upshifts quickly to keep engine speeds low – for relaxed, quiet cruising. Rapid accelerator pedal movement and frequent changes in acceleration – as one might experience on a twisty stretch of road – trigger a change to a sporty shift map that holds lower gears longer to make use of engine speed. Tiptronic S will immediately switch to the shifting map appropriate for the driving style. For example, it will switch from "sporty" mode to a more leisurely shift map if the driver leaves a twisty two-lane and enters a residential zone. The Tiptronic S transmission even behaves like a manual transmission when cornering. As the driver quickly releases the gas pedal while entering a corner, Tiptronic S holds the current gear. If the driver then applies the brake, Tiptronic S downshifts to provide engine braking going into the turn and acceleration when exiting. The Tiptronic S control module recognizes cornering by comparing speeds of the inner and outer wheels.

The Tiptronic S transmission uses the following information to determine a shift program and perform shifts:

• Information ... Source:
• Accelerator pedal position ... Throttle potentiometer
• Vehicle speed ... ABS sensors
• Longitudinal vehicle acceleration ... ABS sensors
• Lateral vehicle acceleration ... ABS sensors
• Engine speed Speed ... Sensor/flywheel

A continuously engaging lockup torque converter can lock up in all but first gear to optimize efficiency. To ensure smooth shifting, the Motronic engine control unit slightly reduces engine torque during gearchanges by retarding ignition timing for a fraction of a second. Sliding the shift lever into M from D at any time gives the driver instant manual control of the Tiptronic S transmission. The car will hold the current gear until the driver upshifts or downshifts using thumb switches on the right or left steering wheel spokes. Pushing the "+" button upshifts, and pushing button marked "-" downshifts. Tiptronic S also allows the driver to shift manually with the steering wheel switches even when the shift lever is in \"D.\" Shifts occur instantaneously, with no loss of tractive force. That is, shifting up or down does not reduce engine speed, as it does when taking your foot off

the gas when shifting a manual transmission. The Tiptronic S transmission performs additional functions beyond the capabilities of a traditional automatic transmission. For example, when the driver first starts the car, Tiptronic S operates with a Warm-up program. This shift map delays upshifts and keeps the lockup torque converter open to help bring the engine up to operating temperature rapidly (for optimal performance and lowest emissions). Once underway, Tiptronic S will respond to changes in road grade, delaying upshifts on inclines to sustain climbing power, and holding a gear on descents to provide engine braking. The transmission even helps out in low-traction situations. If the ABS wheel speed sensors detect wheel slip, Tiptronic S will upshift to help restore traction.

Warranty

Every new Porsche car sold in the United States and Canada is covered by a fouryear/ 50,000-mile (80,000 kilometer), bumper-to-bumper limited warranty, which includes Porsche's roadside assistance program. The body and 26-step paint and anti-corrosion process enable Porsche to warrant each car against rust perforation for 10 years and unlimited mileage. In addition, Porsche guarantees the paint finish for three years – also without a mileage limitation.