

## **DRIVING DYNAMICS**

### **ENGINES**

#### **In brief:**

The Volvo S60 is a sports saloon with a strong emphasis on performance, and available with a range of aluminium, turbo, five-cylinder, 20-valve petrol and diesel engines offering the performance expected by premium sports saloon customers.

A range of turbocharged petrol engines starts with a 180bhp 2.0T, then a 210bhp 2.5T, plus the 260bhp T5, but is ultimately topped by the awesome 300bhp S60 R.

These are complemented by two of Volvo's new, refined and economical turbodiesels, the 2.4D and D5, offering 163bhp with 340Nm of torque, and 185bhp with 400Nm of torque, respectively.

Alternatively, a Bi-Fuel model has an engine that runs on both gas (CNG) or petrol with lower, cleaner emissions, and ensures there's a power source to suit every motoring need.

#### **In Full:**

- Range of aluminium, turbo, five-cylinder, 20-valve petrol and diesel engines.
- Four turbocharged petrol engines with generous torque and power with outputs of 180bhp (2.0T), 210bhp (2.5T), 260bhp (T5) and 300bhp (S60 R).
- Two new turbodiesels: D5 185bhp with 400Nm, and 2.4D 163bhp with 340Nm using the latest direct-injection and common rail technology are Euro IV compliant and have a diesel particulate filter as standard for impressive, refined performance, economy, and emissions.
- 2.4-litre, five-cylinder Bi-Fuel model operates on both CNG or petrol. Fully crash tested, with full type approval, built on same production line as standard car and sold with standard three year Volvo Car UK warranty.
- Service intervals: Bi-Fuel and S60 R 12,500 miles or 1 year (whichever comes first), and 18,000 miles/1 year (whichever comes first) for all other petrol and diesel models.

A range of turbocharged petrol engines starts with a 180bhp 2.0T, then a 210bhp 2.5T, plus the 260bhp T5, but is ultimately topped by the awesome 300bhp S60 R.

These are complemented by Volvo's two new, refined, powerful and economical turbodiesels, the 2.4D and D5, offering 163bhp/340Nm and 185bhp/40Nm respectively.

Alternatively, a Bi-Fuel model has an engine that runs on both gas (CNG) or petrol with lower, cleaner emissions, and ensures there's a power source to suit every motoring need.

Technical specifications:

Engine:	2.0T	2.5T	T5	R	2.4D	D5	Bi-Fuel	
Type	1984cc 5 cyl/20v turbo	2521cc 5 cyl/20v turbo	2401cc 5 cyl/20v turbo	2521cc 5cyl/20v turbo	2401cc 5cyl/20v turbo	2401cc 5cyl/20v turbo	2435cc 5cyl, 20v	
Fuel	Petrol	Petrol	Petrol	Petrol	Diesel	Diesel	CNG/petrol	
Power	180 bhp	210 bhp	260 bhp	300 bhp	163 bhp	185 bhp	140 bhp	
Torque Nm at rpm	240 Nm at 1850	320 Nm at 1500	350 Nm at 2100	400 Nm at 1950	340 Nm at 1750	400 Nm at 2000	192/4500 CNG 220/3300 petrol	
0-62mph Man/auto	8.8 man 9.5 auto	7.0 man 7.4 auto	6.5 man 6.9 auto	5.7 man 6.7 auto	9.2 man 9.7 auto	8.2 man 8.7 auto	10.7/11.6 CNG 11.6/11.1 petrol	
Top speed man/auto	140 man 134 auto	146 man 143 auto	155 man 155 auto	155 man 155 auto	130 man 130 aut	143 man 140 aut	130/130 CNG 127/127 petrol	
CO2 g/km	212 man 227 auto	217 man 234 auto	220 man 234 auto	252 man 259 auto	174 man 199 aut	174 man 199 aut	159/176 CNG 208/228 petrol	
MPG man/auto	22.8/20.6	21.9/20.0	22.2/20.2	19.5/18.0	31.4/27.7	31.4/27.7	CNG 22.2/19.9	Petrol 23.7/20.2
Urban	40.9/39.8	40.9/38.7	38.7/38.7	34.4/34.9	54.3/47.1	54.3/47.1	42.8/38.7	41.5/40.9
Extra urban	31.7/29.7	31.0/28.8	30.4/28.8	26.9/25.9	42.8/37.7	42.8/37.7	31.7/28.8	32.5/29.7
Combined								

Steering/tyres	Rack and pinion with 205-235 (16in-18in) section tyres. S60 R: 18in 235/40Y Pirelli P-Zero Rosso
Turning circle, m (ft)	11.9 – 12.0 (38ft 9in – 39ft 4in). S60 R: 13.0 (42.7)
Transmission	5 speed manual (2.0T, 2.5T, Bi-Fuel) 6 speed manual (2.4D, D5, T5 and S60 R) Auto: 5 speed (2.0T, Bi-Fuel) Geartronic: 5 speed (2.5T, T5); 6 speed (2.4D, D5, S60 R)
Brakes: Front discs	15in – 286mm Ventilated (2.4D, D5, Bi-Fuel) 16in – 305mm Ventilated (2.0T, 2.5T) 16.5in – 316mm Ventilated (T5)
Rear discs	330mm ventilated (S60 R) 288mm (all models) 330mm (S60 R)
Fuel Tank litres (gallons)	70 (15.4) Bi-Fuel: CNG 23Nm <sup>3</sup> /petrol 29 (6.4)
Load capacity: litres (cu ft)	394 (13.9)
Rear seats down	808 (28.5)
Load length: rear seats up	824mm
Load length: rear seats down	1661mm
Dimensions: (mm)	
Length	4603
Width (excluding mirrors)	1813
Unladen height	1428
Wheelbase	2715
Front track width	1561
Rear track width	1542

(Full technical data, prices and options information available in price lists, downloadable at [www.media.volvocars.co.uk](http://www.media.volvocars.co.uk))

The S60 uses four of Volvo's 'RN' five-cylinder, all aluminium petrol engines. These are turbocharged (except Bi-Fuel) and feature four valves per cylinder, a twin cam head, centrally mounted spark plugs and Dual Continuously Variable Valve Timing (CVVT) to optimise the combustion process. CVVT permits a dynamic variation in the outlet timing (up to 20 degrees), improving low-end torque and cutting fuel consumption. The system works on the inlet and exhaust camshaft and makes it possible to close the inlet valves earlier in relation to opening the outlet valves. This generates more torque at lower engine speeds.

### 2.0T

With a low-pressure turbo, the 1984cc, 2.0T version offers a generous 180bhp of power and was recently tweaked to provide the flexibility of maximum 240Nm of torque right from as low as 1,850rpm (previously 2,200rpm) up to 5000rpm, providing a 0-62mph sprint of 8.8sec, a 140mph top speed, and emissions of 212 g/km.

### 2.5T

Also using a low-pressure turbo, the larger 2521cc unit in the 2.5T develops 210bhp with a generous 320Nm of torque available from just 1500rpm up to 4,500rpm. The 2.5T sprints from 0-62mph in just 7.0sec and can reach a maximum of 146mph. But despite this impressive performance, the 2.5T engine returns 31mpg (in manual form) on the official Combined test cycle, with emissions of 217 g/km.

### T5

The T5 employs a larger low-pressure turbo than the 2.5T engine to deliver greater performance – and fun.

The T5 was upgraded from 2005 model year with a larger 2401cc unit (instead of 2319cc) and a power increase from 250bhp to 260bhp at 5500rpm, while an increased 350Nm of torque is available all the way from 2100-5000rpm. With the standard six-speed manual gearbox, the S60 T5 sprints from 0-62mph in 6.5sec, but can still return over 30mpg on the official Combined cycle.

### S60 R

For maximum performance and exhilaration, the S60 range is topped by the S60 R. The five-cylinder, 2.5-litre high-pressure turbo, 2521cc engine provides extremely dramatic performance with a peak power output of 300bhp and 400Nm of torque available from just 1,950rpm, ensuring that the engine is as flexible as it is potent.

With the standard six-speed gearbox, working with the Haldex AWD system (revised from 2006 models to provide Instant Traction) and the active Four-C chassis, this performance flagship can rocket from 0-62mph in just 5.7sec and on to an electronically limited top speed of 155mph.

#### 2.4D and D5

In the UK, the majority of Volvo S60 customers choose the performance, economy and range of a diesel engine. And from the 2006 model year, Volvo now offers S60 drivers a choice of two new, substantially updated versions of Volvo's acclaimed and refined 2.4-litre, five-cylinder turbodiesel: the 2.4D and D5.

Both new diesel engines offer a six-speed manual gearbox or the option of a new six-speed Geartronic available.

These enhancements have been achieved as a result of customer feedback and achieved by the following technological developments and extensive changes to performance characteristics of the D5 diesel engine - see following details:

- New electronic glow plug system for faster starting.
- More advanced injection process with 7 spray holes (instead of 5) in each injector for complete fuel atomisation and more efficient combustion and enhanced performance.
- New, larger and more efficient turbocharger with electronic control for faster/more precise control of charge pressure; plus larger compressor wheel, new cambered vanes for improved response at all speeds, and reduced turbo lag.
- Turbo centre housing now water cooled to provide continued cooling after engine stops.
- Improved flow of air/exhaust gases for optimal flow and reduced drop of pressure.
- More powerful engine management system with more sensors to improve regulation.
- EGR (Exhaust Gas Recirculation) system modified for improved flow/regulation.
- New, more effective cooling system for EGR.
- New, faster, electronically controlled throttle moves EGR gases/ regulates temp better.
- Air swirl in combustion chamber is now infinitely variable for more efficient combustion.
- Increased volume for combustion chambers, and consequently a lower compression ratio.
- Larger catalytic converter with oxygen sensor for more precise emissions control.
- NOx emissions reduced by 50%
- Maintenance free, coated diesel particulate filter (Euro IV compliant) automatically burns off soot particulates approximately every 500 miles.
- Low emissions superior to Euro IV control standard requirements:

	<u>Euro IV requirement</u>	<u>D5 (S60 example)</u>
CO (Carbon monoxide)	0.500 g/km	0.207 g/km (58% better than required)
NOx (nitrogen oxide)	0.250 g/km	0.187 g/km (25% better than required)
Particulates	0.025 g/km	0.001 g/km (96% better than required)

The new 2.4D, Euro IV engine develops 163bhp and 340Nm of torque from 1,750rpm to 3,000rpm (similar to previous D5), which guarantees excellent mid-range flexibility with a top speed possible of 130mph and a 0-60mph time of 9.2 seconds (slightly quicker than 9.5 seconds of the previous D5). Yet despite strong performance, the S60 2.4D achieves 54.3mpg on the extra-urban cycle, and 42.8 miles on a gallon of diesel on the Combined cycle. With the new, coated diesel particulate filter particulate emissions are reduced by 96 per cent. The 2.4D has carbon dioxide emissions of 174g/km, while all other emissions are now substantially below the levels required by the Euro IV compliance.

From 2006 model year, the new D5 Euro IV engine received a significant power boost from 163bhp to 185bhp, now boasting the same levels of torque as the S60 R, 400 Nm, from just 2000 rpm. This flexible performance provides a potential top speed of 143mph, with 0-62mph now possible in 8.2 seconds (compared to the previous D5's 9.5 seconds).

### Bi-Fuel

Lower, cleaner emissions and savings on fuel costs are major benefits of Volvo's 2.4-litre, five-cylinder Bi-Fuel engine that runs on both gas (CNG) and petrol. CNG is substantially cheaper than petrol or diesel, particularly for commercial customers who can 'bunker' gas supplies for their fleets.

In contrast to some of its rivals, Volvo's Bi-Fuel cars are built on exactly the same production line as the rest of the range, rather than converted after production, with gas tanks completely concealed under the loadspace, and enjoy full type approval and the standard three year Volvo Car UK warranty.

The provision of Bi-Fuel power was also integral to the Volvo S60's original design and so the additional fuel tank has been accommodated without any impact on luggage capacity. What's more, once registered, Bi-Fuel models enjoy an exemption from London's current congestion charging regulations.

The 2435cc Bi-Fuel engine is the only normally aspirated engine in the S60 range and is intended to primarily run on CNG (Compressed Natural Gas), with petrol as the reserve fuel. The power output is unchanged at 140bhp whether the car is running on petrol or gas, but the torque and emissions figures vary slightly.

In petrol form, the Volvo S60 Bi-Fuel develops 220Nm of torque and CO2 emissions of 208g/km (CNG), which compares with 192Nm and 159g/km for CNG.

In terms of performance, with a manual gearbox, the Volvo S60 Bi-Fuel sprints from 0-62mph in 10.2sec in petrol mode, while it takes 10.7sec for the CNG variant.

## **DRIVING DYNAMICS**

### **CHASSIS**

#### **In brief:**

**The Volvo S60 was designed from the outset to be an engaging sports saloon, delivering driving pleasure with a high level of active safety.**

**The combination of a sophisticated multi-link suspension set-up with extensive use of lightweight aluminium components, with high torsional rigidity, a class-leading track width and the latest electronic DSTC (Dynamic Stability and Traction Control) stability systems ensure the S60 is always a pleasure to drive.**

**An optional Sports Handling Pack is also available, which features larger 18in alloy wheels, speed dependent steering, and Volvo's advanced, second generation Four-C (Continuously Controlled Chassis Concept) active chassis with Sport and Comfort settings.**

**However, for drivers seeking the ultimate high-performance all-rounder there is the S60 R. This 300bhp flagship saloon has Volvo's new All Wheel Drive (AWD) with 'Instant Traction' coupling that works in conjunction with Volvo's active 'Four-C' sports chassis with Advanced Sport as well as Sport and Comfort settings, has been specifically tuned for the variety of UK road conditions.**

#### **In Full:**

- High-performance sports saloon with high level of active safety.
- Sports chassis standard.
- High torsional rigidity of over 20kNm/degree.
- Sophisticated multi-link rear suspension with extensive use of lightweight aluminium components.
- Long wheelbase and wide front track provide stability and control.

- Dynamic Stability and Traction control (DSTC) standard on all models.
- Sports Handling Pack available (optional).
- Volvo's 'Four-C' active chassis available (standard on S60 R, optional on other models)
- Volvo S60 R features Volvo's 'Four-C' active sports chassis and AWD with Instant Traction™ using the electronic Haldex coupling.

The Volvo S60 was designed from the outset to be an engaging sports saloon, delivering driving pleasure with a high level of active safety. The combination of a sophisticated suspension set-up with extensive use of aluminium components, high torsional rigidity, class-leading track width, and the latest electronic DSTC (Dynamic Stability and Traction Control) stability systems ensure the S60 is a pleasure to drive.

High torsional rigidity allows the suspension to do its job properly and its provision was integral to the Volvo S60's design. Extensive use of High Strength Steel (HSS) in the car's construction has resulted in a torsional stiffness in excess of 20kNm/degree, compared with a typical rating for a four-door saloon of between 6 and 14kNm/degree. This benefits not only the ride and handling characteristics of the Volvo S60, but also its crash-worthiness.

#### Suspension

All UK specification S60s (except Bi-Fuel) have Volvo's sports chassis set-up. An independent, MacPherson strut arrangement at the front incorporates anti-lift and anti-dive technology to enhance the car's stability in all conditions. At the rear, the Volvo S60 employs a sophisticated multi-link system, mounted in a chill-cast aluminium subframe. This permits a small degree of passive rear-wheel steer when cornering, to maximise stability and control. Anti-roll bars also feature at both ends.

The class-leading front track width and long wheelbase provide a further contribution to the Volvo S60's exceptional stability. The wide track helps improve the car's balance, enabling it to cope with high cornering forces, while providing clear and consistent feedback to the driver. Likewise, the long (2715mm) wheelbase contributes to a balanced weight distribution with a low minimal moment of inertia. In practical terms, this enhances the steering response and helps ensure that the Volvo S60 responds in a controlled, predictable manner in all circumstances, making a major contribution to active safety.

#### DSTC, EBD and EBA

The S60's carefully honed mechanical set-up is backed by sophisticated traction and stability control systems. Dynamic Stability and Traction Control (DSTC) is standard on every model

and prevents wheelspin by either braking the wheel that has lost traction (up to 25mph) or, at speeds above 25mph, by reducing engine power and using extra sensors to detect the onset of a skid. The system then automatically slows the appropriate wheel to restore control. It ensures that the driven wheels get exactly as much power as they can transfer to the road.

All S60's benefit from ABS brakes with EBD (Electronic Brake Distribution) and EBA (Electronic Brake Assist) which senses an emergency stop and automatically brings the car to a halt in as short a distance as possible.

Enthusiastic drivers can choose to enhance the S60 further with the options of lowered sports chassis with load compensating suspension, Sport Handling Pack or Volvo's advanced 'Four-C' (Continuously Controlled Chassis Concept) active chassis system.

#### The Sports Handling Pack

For more responsive handling and some added 'cool' appearance, a Sports Handling Pack includes 18in 235/40 Nebula BBS split rim or 18in 235/40 Eudora alloy wheels, Volvo's active 'Four-C' chassis and speed dependent steering.

#### Active 'Four-C' Chassis

The advanced electronics of Volvo's active 'Four-C' (Continuously Controlled Chassis Concept) technology allow all of the car's dynamic systems to communicate and work in unison and has now been specifically optimised for the variety of UK road conditions.

The car's speed, wheel movement and steering are continuously monitored via Multiplexed control systems that update the suspension settings 500 times per second.

The advanced electronics allow the driver to choose between different suspension settings at the touch of a button on the dashboard for maximum driver choice, control and enjoyment.

The system is designed to help counteract the cars natural dynamic tendencies:

- TAKE OFF: When accelerating away from standing start, the rear dampers are set to maximum stiffness to help prevent acceleration squat and optimise front wheel traction.
- BRAKING: When braking the front dampers are stiffened to reduce 'brake dive'. This allows greater rear end grip so more rear braking effort can be used.
- CORNERING: When cornering the outside dampers are stiffened to reduce roll and provide extra grip and traction. On the S60 R, the dampers works in unison with the AWD with Instant Traction™ to induce a degree of 'turn-in' oversteer. During the corner the

dampers and AWD system balance power for a neutral stance. When exiting a corner, the dampers are set to allow maximum traction for the front wheels, to pull the car out of the corner.

For the S60 R the 'Four-C' system works in conjunction with the new sophisticated AWD (All Wheel Drive) with Instant Traction™ system. Developed in conjunction with the Swedish specialist Haldex, the new AWD operates independently of driver input, distributing torque automatically between the front and rear wheels via an electronically controlled coupling for the best possible grip in all conditions. On take off, power is fed to all four wheels then will balance to optimise performance and reduce fuel consumption.

The intelligent AWD system uses a variety of sensors to monitor the road surface and the steering wheel, brake and accelerator pedal positions. In normal driving conditions on dry roads, almost all the power is distributed to the front wheels. The new 'pre-charged' function uses a non-return valve within the coupling making 80Nm of torque instantly available to the rear wheels if the sensors detect any slippage.

Standard models with the Four-C system have the choice of Sport or Comfort chassis settings, which are tuned for a more sporting ride for the S60 (compared to V70 or XC70). However, this is taken one stage further for the S60 R when the system offers Sport, Comfort and an additional third setting – Advanced Sport:

**Sport** – Standard mid-setting for sporty driving. ('Sky-hook' control technique)

**Advanced Sport** – Uncompromising sports car handling, prioritising maximum driving pleasure using 'direct road contact' control technology, ('Road Contact' control technique)

**Comfort** – Optimises ride comfort using 'Sky Hook' control technology to make the car feel like it is suspended from an artificial horizon. ('Sky-hook' control technique)

### **DRIVING DYNAMICS:**

#### **STEERING, BRAKES AND TRANSMISSIONS**

##### **In Brief:**

**The Volvo S60's power assisted ZF rack and pinion steering (available with optional speed-sensitive function) is responsive and offers plenty of driver feedback, while the anti-lock brakes are boosted by Electronic Brakeforce Distribution (EBD) and Electronic Brake Assist (EBA).**

**A five-speed manual is standard in 2.0T, 2.5T and Bi-Fuel models, while the 2.4D, D5, T5 and S60 R have six-speed gearboxes. But for those who prefer to let a computer take the strain, Volvo offers two five-speed automatic transmissions and a new six-speed Geartronic. All adapt their shift points to suit individual driving styles, but the Geartronic system also permits sequential manual changes for added control.**

In Full:

- Power-assisted rack and pinion steering tuned to optimise feedback and response. Speed sensitive steering also available (optional).
- Anti-lock brakes (ABS) with Electronic Brakeforce Distribution (EBD) and Electronic Brake Assistance (EBA) standard on all models.
- Six-speed manual standard on 2.4D, D5, T5 and the S60 R. Five-speed manual standard on 2.0T, 2.5T and Bi-Fuel.
- 'Spaceball' aluminium gearlever std on manual T5, Sport models and S60 R
- Five-speed adaptive automatic available (optional).
- Five-speed Geartronic adaptive automatic with sequential manual shift facility available on 2.5T and T5, and a six-speed Geartronic on the 2.4D, D5 and S60 R.

The Volvo S60 uses a power-assisted ZF rack and pinion steering system that has been developed to optimise driver feedback and response. The steering feel has been improved through careful tuning of the torque build-up during cornering. This helps the driver place the car accurately on the road and to assess the available grip.

An optional speed dependent steering is available that provides additional assistance at low speeds and more steering feel as speed increases.

The large disc brakes are derived from those fitted to the larger, heavier Volvo S80, and have been designed to reflect the car's sporting potential. Larger, four-piston Brembo brakes front and rear ensure the S60 R's braking matches its performance. And as you'd expect from Volvo, an anti-lock braking system is fitted as standard, plus DSTC (Dynamic Stability and Traction Control), joined by Electronic Brakeforce Distribution (EBD) and Electronic Brake Assist (EBA).

EBD constantly distributes braking power between the front and rear wheels to ensure maximum retardation regardless of the road conditions or how the car is laden. EBA

automatically senses when an emergency stop is required and adjusts the braking pressure so that the car comes to a halt in the shortest possible distance.

Five different transmissions are available on the Volvo S60. The 2.0T, 2.5T and Bi-Fuel engine models have a five-speed manual gearbox, while for added flexibility the 2.4D, D5, T5 and S60 R have a sixth ratio.

A stylish, aluminium 'Spaceball' gearlever is standard with manual transmissions on all Sport models, the T5 and S60 R, but also available as an option for other models.

For drivers who prefer to let a computer take the strain, Volvo has a choice of three automatic gearboxes. There's a fully adaptive five-speed unit available for the 2.0T and Bi-Fuel that automatically adjusts its shift patterns according to an individual's driving style. This is upgraded to a fully adaptive Geartronic system for the rest of the range that also offers the driver the opportunity to choose gears manually. Gears are selected sequentially by tipping the lever forwards to change up and backwards to change down. A five-speed Geartronic is available for the 2.5T and T5, while a new ultra-compact, high-torque six-speed Geartronic unit is offered for the 2.4D, D5 and S60 R.