This press pack accompanied the UK launch of the fourth generation Lexus LS in December 2006. Some changes were made to the model range during its time on sale, which can be tracked using the Timeline feature available on the LS archive web page. Additional assets and information relating to the LS range may be obtained from the Lexus press office if required.

THE NEW LEXUS LS 460

KEY POINTS

- All-new fourth generation of Lexus's flagship model
- Eight world-firsts in safety, driver assistance and powertrain technology
- All-new 4.6-litre V8 engine with Dual VVT-i and VVT-iE
- Maximum power 375bhp (380 DIN hp) at 6,400rpm and maximum torque 493Nm at 4,100rpm
- Nought to 62mph acceleration in 5.7 seconds, 50 to 75mph in 4.7 seconds
- Excellent balance of performance, fuel economy and emissions
- World's first eight-speed automatic transmission
- Advanced Safety Pack
    - Advanced Obstacle Detection system (world first)
    - Driver Monitoring System (world first)
    - Emergency Steering Assist (world first)
    - Rear Pre-Crash Safety system (world first)
    - Lane-Keep Assist system (segment first)
    - Adaptive Cruise Control and Pre-Crash Safety system
- New design is strongest interpretation yet of Lexus's L-finesse design philosophy
- New manufacturing techniques achieve unprecedented tolerances for bodywork and component fit and finish
- Automated manufacturing processes combined with human skills of master craftsmen to produce highest levels of measurable and perceived quality
- Available in three grades: LS 460, 460 SE and 460 SE-L
- DVD satellite navigation with dynamic route guidance, Bluetooth connectivity, parking assist monitor, leather upholstery, heated and air conditioned front seats and 10-speaker sound system standard on all LS 460 models
- New 19-speaker Mark Levinson premium hifi with six-disc DVD autochanger standard on LS 460 SE and SE-L models

- On sale in the UK from 8 January 2007
- On-the-road prices from £57,000

PRODUCT CONCEPT

The new LS 460, the fourth generation of Lexus's luxury flagship, represents a major departure in creative thinking for the company. In order to produce a car that fully addresses the demands of the 21st century premium market, Lexus moved away from a philosophy of evolution and sought instead to challenge every aspect of conventional engineering wisdom.

In line with Lexus's legendary "relentless pursuit of perfection", no effort has been spared in ensuring the LS 460 delivers the finest standards in safety and environmental performance, re-establishing the model's reputation for being the world's most advanced premium saloon and redefining the meaning of luxury within its segment.

The engineering team, led by Moritaka Yoshida, even reassessed the manufacturing process and, recognising that in some areas human skills are better than automated operations, established a new production system, "Advanced Craftsmanship". This intricately combines state-of-the-art mechanised systems with exquisite craftsmanship undertaken by highly skilled technicians.

Design and engineering are human-focused, ensuring that, in spite of its technical sophistication, the LS is a car that is a pleasure to drive with exceptional ride comfort, safety and driving dynamics.

For the first time the LS is being offered as a range rather than a single model. The new LS 460 is additionally available in SE and SE-L grades and, during 2007, it will be joined by the LS 600h, the world's first petrol-electric hybrid power car in the segment. The line-up will also include the first long-wheelbase production Lexus, the LS 600hL, offering a first class travelling experience.

DESIGN AND REFINEMENT

The new LS 460 was conceived at the Lexus Design Centre and is the strongest representation yet of L-finesse, the design philosophy that is shaping a new generation of models, including the latest IS and GS.

The car is 15mm longer overall, 45mm wider and has a 45mm longer wheelbase. The sleek design features prominent wheelarches and a deep front air dam, giving the car a stronger,

more muscular appearance, while the “Intriguing Elegance” central to L-finesse design can be witnessed in the contrasting concave and convex shadow surfacing on the bodywork.

Quality has been raised throughout, both measurable and perceived, using a combination of the latest manufacturing techniques and the specific, unmatched skills of master craftsmen. The human touch is fundamental to a number of elements in the production process, including hand polishing and buffing and even the final checks on the quality of engine note.

The cabin reflects the ground-breaking advanced safety features incorporated in the new LS in a design that emphasises protection, luxury and tranquillity. It is divided into four independent areas, the shape of the door trim and seats designed to give each occupant a feeling of being securely enveloped in the car.

The LS 460’s intelligent technology extends to the ergonomics, the feel and function of the switchgear and the enhanced visibility of the Optitron instrumentation. The attention to detail extends to the surface of each button being shaped to alternate between concave and convex to make individual controls easy to find, and to each lid in the cabin opening in the same direction and at the same speed.

POWERTRAIN

The LS 460 is powered by a new 4,608cc V8 engine, a completely new unit that is the most technologically advanced unit Lexus has built.

Every aspect of the engine’s operation has been re-thought from scratch. New high-rigidity components have been developed, the best balance achieved in all moving parts and friction minimised and unprecedented precision applied in the assembly to give the V8 benchmark performance in terms of refinement, quietness and durability.

The engine gives a class-leading balance of performance and fuel efficiency. It is one of the most powerful in its class among normally-aspirated V8s, producing 81.4bhp (82.5 DIN hp) per litre. Maximum output is 375 bhp at 6,400rpm and maximum torque 493Nm at 4,100rpm (specific torque 107Nm/l).

Matched to a new, unique eight-speed automatic transmission, the V8 will accelerate the LS 460 from nought to 62mph in 5.7 seconds and from 50 to 75mph in 4.7 seconds. Top speed is electronically limited to 155mph.

In spite of these performance figures, the engine is also one of the most economical among V8s with a capacity of more than four litres, returning 25.4mpg in combined cycle driving and carbon dioxide emissions of 261g/km.

The new engine features an over-the-engine dual-pipe intake system with compact air filter elements and an Acoustic Control Induction System (ACIS) to optimise the fuel-air mixture. The D-4S (Direct Injection 4-stroke Superior version) injection system – the only automotive injection system in the world to use two injectors per cylinder – is combined with Lexus's Dual VVT-i intelligent valve timing system.

The variable intake and exhaust valve timing incorporates VVT-iE, the world's first electrically operated camshaft variable valve timing system, capable of operating across the full spectrum of engine speed and temperature. A further new feature of the engine is a semi-dual exhaust manifold that reduces interference in the exhaust, improving output.

The V8 is matched to the world's first eight-speed automatic transmission. Constructed with a remarkably light and compact casing, it offers the widest spread of gear ratios in its class, supporting a best-in-segment combination of acceleration performance and fuel economy. The highly rigid casing and precision gears contribute to making it the smoothest and quietest transmission Lexus has produced.

Gear changes are quicker and remain almost imperceptible. Furthermore, a new Intelligent Powertrain Control System optimises the speed and smoothness of any shift and gives a faster and more precise response to other ECU demands, such as from the Vehicle Integrated Dynamics Management or Pre-Crash Safety system ECUs.

Every care is taken to ensure the engine transmits minimal noise and vibration to the cabin, and every engine is tested under its own power to check the smoothest operational balance has been achieved.

BODY AND CHASSIS

The new LS 460 uses a new platform and bodyshell. It is built to the highest manufacturing tolerances, with the body structure's weight, balance, inertia moments and torsional rigidity honed to provide the best possible ride comfort, high speed stability and superior chassis response.

Using a combination of ultra-high tensile steel and aluminium components gives the car a very stiff yet lightweight body, with minimal transmission of vibration and highest torsional rigidity in the segment, 30 per cent greater than its predecessor, the LS 430. Manufacturing accuracy and torsional rigidity are also improved through the use of double the amount of high precision laser welding.

The sleek bodywork has exceptionally narrow panel gaps and minimal protrusions, while numerous aerodynamic under-body elements are used to create a smooth and flat surface beneath the car to improve stability and reduce wind noise. The drag coefficient of 0.26 makes the LS 460 the most aerodynamically efficient car in its class.
Front and rear suspensions have a multilink design. New pneumatic springs, with 20 per cent greater air pressure, are used in conjunction with an improved Adaptive Variable Suspension system (AVS). AVS now features a vehicle posture control, to synchronise roll and pitch when cornering to improve comfort for passengers.

The steering system is new, too: a high-power 46V motor-driven speed-sensitive Electric Power Steering with Variable Gear Ratio Steering (VGRS). VGRS alters the ratio by up to 30 per cent – from 2.5 to 3.6 turns lock-to-lock – to give the best response and feedback according to vehicle speed.

The LS 460 is the only car in its segment to use an electro-hydraulic braking system, with 357mm ventilated discs at the front and 335mm ventilated discs at the rear. The revised Electronically Controlled Braking system uses a new ECU with an improved processing speed, providing independent hydraulic braking power to each of the four wheels for more precise brakeforce distribution and better operation of the car's VDIM and other brake control systems.

SAFETY AND DRIVER ASSISTANCE SYSTEMS

The new LS 460 has a higher content of sophisticated safety technology than any other car and showcases a series of major developments Lexus has achieved in anticipatory safety – systems which detect when an accident is likely to happen and intervene to help the driver avoid a collision, or reduce the risk of injury to both occupants, pedestrians and other road users.

These elements are contained in a new advanced Pre-Crash Safety (PCS) system, a package that is provided as standard on the LS 460 SE-L and which is available as an upgrade option on other versions. They include four world firsts in preventive safety: an

Advanced Obstacle Detection System, Driver Monitoring System, Emergency Steering Assist and Rear Pre-Crash Safety.

The Advanced Obstacle Detection System uses information from a millimetre-wave radar and a near-infrared camera to detect a wide range of obstacles up to 25 metres ahead of the vehicle by (subject to weather conditions) both day and night, including pedestrians. Once an obstacle has been identified, the object's speed and direction are used to calculate the likelihood of a collision. If the probability is high, a buzzer sounds and a BRAKE! Warning lights up on the dashboard display. At the same time, PCS activates a series of integrated safety systems: the VGRS, to improve response to driver input; AVS, to stiffen the dampers to control nose dive when braking and improve chassis response to the driver's steering input; VDIM, to improve vehicle stability during evasion manoeuvres; and the Pre-Crash Brake Assist System, to provide maximum stopping power as soon as the driver presses the brake pedal.

If the system subsequently determines a collision is unavoidable, PCS pre-tensions the front seatbelts and Pre-Crash Brake is applied.

The Driver Monitoring System constantly monitors side-to-side movement of the driver's head, using an infrared camera mounted on the steering column. If it detects the driver has his or her head turned away from the road ahead when the car is moving and an obstacle is detected in its path, the system activates the Pre-Crash warning function. If the driver still fails to respond, the brakes are briefly applied. If both actions fail to gain a response, all the other Pre-Crash functions are engaged.

The Rear Pre-Crash Safety system uses a millimetre-wave radar in the rear bumper to constantly scan the area around the back of the vehicle. If a collision is deemed unavoidable, the front seat Pre-Crash Intelligent Headrests are automatically moved forwards and upwards in anticipation of the impact, greatly reducing the risk of whiplash injury. The system works both when the LS is moving and when stationary.

The driver assistance systems include Lane Keeping Assist, which helps the driver maintain the right road position; Intelligent Parking Assist, which controls the steering for precise series and parallel reverse parking

manoeuvres; and a Brake Hold function, which prevents the car from rolling backwards when temporarily stopped on steep gradients.

The latest-generation VGRS works with the Vehicle Dynamics Integrated Management (VDIM) to improve traction control and vehicle stability.

The comprehensive airbag protection includes front and knee airbags for the driver and front passenger, front and rear side airbags and full-length side curtain airbags. The front passenger airbag has a twin-chamber design which cradles the face and disperses impact pressures over a wider area of the head, shoulders and upper body.

COMFORT, CONVENIENCE AND ENTERTAINMENT

A class-leading range of technologically advanced equipment makes life on board both simpler and more pleasant. Comfort, convenience, discreet hospitality and carefully considered driver interaction are the guiding principles. The quality and attention to detail are evident from the moment you approach the vehicle, through the handy card key access, closing assistance that means there's no need to slam the doors closed, a powered boot lid closer (SE and SE-L models), sequenced illumination that corresponds to the entry or exit of driver and passengers, and push-button engine start-up.

Key features include front and side laminated windows, four-zone air conditioning with the world's first Roof Climate Diffusers (SE and SE-L models), a high-speed satellite navigation system with traffic avoidance function and Electronic Multi-Vision touch-screen display, and voice command recognition for control of audio, ventilation, navigation and Bluetooth hands-free phone functions. The LS 460 is the first car in its class to provide a rear parking assist monitor as standard.

The standard 10-speaker sound system has a single-slot six-disc in-dash CD autochanger and additional audio controls mounted on the steering wheel. For the ultimate in on-board entertainment, the SE and SE-L models are equipped with the latest 19-speaker, 450W Mark Levinson Reference Surround System (optional on LS 460). Using the Electro Multi Vision display screen, it delivers a complete, discrete 5.1 home theatre entertainment experience for music, music videos and DVD movies.

Rear seat passengers can enjoy the system using a retractable, ceiling-mounted nine-inch LCD wide screen while the car is moving. The front EMV screen can only be used when the vehicle is stationary.

A new Power Control ECU monitors systems which continue to function when the vehicle is parked and checks changes in battery current, voltage and temperature. It will automatically instigate measures to ensure the durability and reliability of the car's power supply are not compromised.

MANUFACTURING

Lexus has developed a totally new production process for the LS 460 at its Tahara factory. Advanced Craftsmanship integrates Lexus's legendary manufacturing quality with a focus on perceived quality – those aspects of a car which cannot be physically measured or quantified, but which contribute a great deal to the car's overall quality.

Using a number of techniques unique within the industry, Advanced Craftsmanship combines advanced automated manufacturing operations and digital measurement technology with the expertise of highly trained master craftsmen at every stage of development, production and quality control.

The highest levels of engine assembly precision were required to meet Lexus's exacting design requirements. As well as a significant increase in individual component manufacturing precision, a rigorous inspection process was introduced to check assembly tolerances against design parameters every time high precision parts are combined.

The skills of master craftsmen are called on in every part of the manufacturing process, particularly in the mirror-finish polishing of engine friction points and micro-laser polishing of transmission gear teeth. Every engine undergoes detailed noise and vibration analysis with a focus on the quality of the engine note.

LEXUS LS 460 AND THE UK MARKET

The new Lexus LS 460 will go on sale in the UK on 8 January 2007. In 2007, Lexus GB aims to sell more than 500 units, together with around 250 examples of the hybrid power LS 600h, due for launch during the year.

THREE EQUIPMENT GRADES

Unlike previous LS models, the new car will be available in three versions, widening its customer appeal: LS 460, LS 460 SE and LS 460 SE-L.

Lexus LS 460 key equipment features

LS 460:

- DVD satellite navigation with dynamic route guidance
- Parking assist monitor
- Dual zone climate control
- Leather upholstery
- Voice command function for audio, navigation, Bluetooth and climate control operation
- 10-speaker sound system
- Bluetooth connectivity
- Smart entry and start-up system
- Electrically adjustable front seats
- Memory settings for front seats, steering wheel and door mirrors
- Electrically adjustable rear head restraints
- 8in Electro Multi Vision touch-screen display
- 18in alloy wheels

LS 460 SE adds

- Power boot closer
- Mark Levinson 19-speaker premium hifi with 6-disc DVD autochanger
- Rear audio controls
- Power sunshades for rear doors
- Rear Seat Upgrade Pack including:
    - Four-zone climate control with rear roof-mounted diffusers
    - Rear cool box and wood console
    - Air conditioned rear seats
    - Electrically adjustable rear head restraints with memory setting
    - Electric rear seat slide and recline
- Sunroof

LS 460 SE-L adds

- Advanced Safety Pack
- Intelligent Park Assist system
- 19in alloy wheels
- Card Key smart entry and start system
- Upholstery Upgrade Pack including:
    - Semi-aniline leather upholstery and trim detailing

- Alcantara roof headlining and pillar finishing

Option upgrade packs

REAR SEAT UPGRADE PACK (£3,500)

- Cool box
- Power rear seat slide and recline
- Power rear head restraint with memory function
- Air conditioned rear seats
- Four-zone air conditioning
- Rear climate controls with separate left and right adjustment
- Roof-mounted diffusers
- Rear audio controls
- Power sunshade for rear doors
- Wood console pack

UPHOLSTERY UPGRADE PACK (£1,500)*

- Semi-aniline leather upholstery and trim detailing
- Alcantara roof headlining and pillar finishing

ADVANCED SAFETY PACK (£3,750)*

- Adaptive Cruise Control and Pre-Crash Safety system
- Advanced Obstacle Detection
- Rear Pre-Crash Safety system
- Driver monitoring system
- Emergency Steering Assist
- Lane Keep Assist
- Lane Departure Warning system

*The Upholstery Upgrade Advanced Safety packs can only be specified in conjunction with the Rear Seat Upgrade Pack and sunroof.

Competitor comparisons

It is a hallmark of Lexus models that they provide exceptional value for money, in addition to superb refinement, ride comfort and driving dynamics. This is particularly true of the new LS 460, a car that offers owners much more for their money than its principal rivals.

Taking as an example the LS 460 SE, the specification includes many items as standard that are only available as extra-cost options on competitor models. For example, the rear nine-inch VGA screen for watching DVDs while on the move adds an extra £5,000 to the price of an Audi A8 4.2 quattro SE, while electric slide and recline adjustment for the rear seats increases the cost of a BMW 740i Sport by more than £2,000. The Mercedes-Benz S500 has little to match the Lexus's equipment manifest: to specify the car to match the LS 460 SE would add more than £19,000 to the on-the-road price.

Full details of how the LS 460 and its rivals match up are provided in the comparison table below.

LS 460 SE COMPETITOR COMPARISON

	LEXUS LS 460 SE	AUDI A8 4.2 QUATTRO SE	BMW 740i SPORT	MERCEDES-BENZ S 500
On-the-road price	£65,000	£58,315	£60,225	£69,815
Touch-screen 8in display	✓	✓	£855	✓
19-speaker premium audio system (Mark Levinson)	✓	£725	£520	£755
In-dash 6-disc DVD changer	✓	×	×	×
Rear seat entertainment with open/close 9in VGA screen	✓	£5,000	£2,450	£3,200
Bluetooth connectivity	✓	×	✓	×
Parking assist monitor	✓	×	×	£660
Intelligent Park Assist	✓	×	×	×
Park assist sensors	✓	✓	✓	£605
Smart entry and start system	✓	✓	£830	£820
Power rear seat slide and recline	✓	£675	£2,065	£1,120
Power rear head	✓	×	×	✓

restraints with memory				
Heated and air conditioned front seats	✓	£5,200	×	£660
Heated rear seats	✓	✓	£300	£320
Rear air conditioned seat	✓	✓	£535	£660
Electrically adjustable front seatbelts (memory for driver)	✓	×	×	×
Electric rear sunshade	✓	£700	£830	£365
Electric sunshade for rear doors	✓	✓	✓	£520
Rear cool box	✓	£1,000	×	£800
Rear audio control	✓	×	×	×
Four-zone air conditioning, rear climate control with left and right temperature control	✓	£450	×	£820
HID headlights with cleaners and auto-levelling	✓	£900	£450	✓
Adaptive Front-lighting System (AFS)	✓	✓	✓	£1,100
Auto-dipping heated and folding door mirrors	✓	£240	£510	✓
Rain-sensing wipers	✓	✓	£760	✓
Easy door and boot closer	✓	✓	£440	✓
Power boot closer	✓	£375	£370	£410
Eight airbags	✓	×	×	×
Sunroof	✓	£900	✓	✓
Air suspension	✓	✓	×	✓
Vehicle Dynamics Integrated Management	✓	×	×	×
Tyre Pressure Warning	✓	£400	✓	£245
Alloy wheels	18in	18in	18in	£880
Specification adjusted price	**£65,000**	**£74,880**	**£71,140**	**£84,200**
Adjustment vs Lexus LS 460 SE	-	£9,880	£6,140	£19,200
Price position vs Lexus LS 460 SE	-	15.2%	9.4%	29.5%

Prices, insurance and Vehicle Excise Duty

On-the-road prices will start at £57,000 for the LS 460 (details of all prices, insurance groups and VED bands are provided in the table opposite).

The LS 460 and 460 SE models have been given a group 18E insurance rating and the LS 460 SE-L a 19E rating. The 18E rating for the LS 460 model is a best-in-class classification.

Lexus LS 460 prices, insurance and VED rating

MODEL	OTR PRICE	INSURANCE GROUP	VED BAND
LS 460	£57,000	18E	G
LS 460 SE	£65,000	18E	G
LS 460 SE-L	£71,000	19E	G

PRODUCT CONCEPT

The genesis of the Lexus brand can be traced back to 1983 and the challenge from the then chairman of Toyota Motor Corporation, Eiji Toyoda, to his senior executives to build “the best luxury car in the world.”

The project took six years and involved 1,400 engineers, 2,300 technicians and 450 prototypes, establishing the core Lexus philosophy of “the relentless pursuit of perfection.” The result was the first-generation LS, the LS 400, which went on sale in North America in 1989. Just two years later, Lexus became the USA’s best-selling luxury import brand, a position it has held ever since.

The LS 400 redefined the concept of quality through the attention paid to even the smallest component, setting the standards for a new generation of luxury vehicles. It featured numerous innovations, including widespread use of laser welding to help create a stiffer, lighter body, and laser body measuring to achieve unprecedented panel fit. Painstaking attention to reducing noise, vibration and harshness levels ensured the LS 400 had an exceptionally quiet and comfortable cabin. Advanced aerodynamics – a class-leading aspect of every LS – endowed the car with a 0.29 coefficient of drag, further contributing to its all-round quiet performance at speed. Comprehensive testing on a scale not witnessed before in the industry ensured outstanding durability and reliability, qualities that are now hallmarks of all Lexus models.

More significantly, however, development of the first LS taught Lexus engineers that massive application of technology alone is not enough when it comes to creating a flagship model. Constant re-analysis of the basic aspects of automotive engineering is needed to ensure that this technology serves a clear purpose, something that has been fundamental to the development of all LS models since.

Seventeen years on from the launch of the first LS, Chief Engineer Moritaka Yoshida and a team of 1,866 engineers have responded to significant changes in the luxury car market, recognising the need to move away from an evolutionary philosophy in crafting the new, fourth-generation LS. A clean break with the past was made by developing all the main components – powertrain, body and platform – from a clean sheet of paper, with the purpose of setting industry benchmarks in key areas such as safety, driving dynamics and NVH.

The new LS 460 also develops the core concept of human-centred engineering and advanced functionality that is inherent in all previous LS models. In addition, the new LS reflects the way society has developed, responding to the needs of a new type of customer who demands the best in safety and environmental performance.

The new LS 460 is the most significant development project since Lexus was founded and demonstrates the marque's commitment to creating entirely new values in the premium automotive market and re-establishing the LS's credentials as the world's most advanced luxury saloon.

DEVELOPMENT CONCEPT

The new LS 460, the fourth generation of Lexus's flagship model, is an all-new car with no major components carried over from the previous generation LS 430. It is the result of the most expensive standard production project in the company's history and sets out once again to redefine the meaning of "premium" in the automotive market.

Moritaka Yoshida and his team developed the new LS 460 around the concept of "Challenging Automotive Evolution." Using the most advanced technology in the motor industry, even the most basic of processes has been re-assessed in order to challenge every aspect of conventional engineering wisdom. Moreover, the car and its technology have been specifically built around its occupants – what Mr Moritaka Yoshida calls human-centre engineering – to anticipate as much as possible passengers' needs.

As well as being the flagship of the range, the new LS embodies Lexus's values and moves the "pursuit of perfection" on to a new level. It is no longer just a single model, but a range designed to meet the needs of different customers. In 2007 the LS 460 will be joined by the LS 600h, the first hybrid model in the premium segment, and the long wheelbase LS 600hL, which will offer a first class travelling experience.

Key elements of the car, such as the platform, engine, transmission and suspension, have been designed to integrate perfectly with the numerous on-board sensors for the LS's advanced safety and driving assistance systems, achieving an exceptionally safe drive with highest levels of ride comfort and dynamic performance.

Among the many innovations, perhaps the most significant is a revolutionary concept that interconnects and integrates several active, electronically managed components to form an intelligent network. Operation of the engine, automatic transmission, Adaptive Variable Suspension and by-wire, stability control and support systems, has been carefully harmonised, delivering unprecedented safety, refinement and driving dynamics.

TECHNOLOGY ALLIED TO EXPERIENCE AND CRAFTSMANSHIP

Moritaka Yoshida has been with Lexus since its inception and began his career as a chassis engineer working on the LS 400 project. He subsequently moved to the Product Planning Division, sharing responsibility for development of the second generation Lexus GS and the current LS 430. With 23 years' experience devoted to the development of Lexus cars, he knows all about the "pursuit of perfection" and the unique mindset that is a quality of all Lexus engineers.

Advanced craftsmanship and a new production process

A new production process was developed for the LS 460 at Lexus's Tahara factory. Combining the latest manufacturing technology with the expertise of master craftsmen at every stage of development, production and quality control has yielded significant improvements, not only in overall, machine-measurable quality, but also in the perceived quality: aspects that can be felt but not measured, such as the touch and gloss of surfaces, the appearance of fit and finishes and even the sound of the engine.

DESIGN AND REFINEMENT

The new LS 460, conceived at the Lexus Design Centre in Aichi, Japan, is the flagship of the Lexus marque and the latest model to be created in line with the company's L-finesse design philosophy.

L-finesse is deeply rooted in Japanese culture of both the past and present and expresses three fundamental elements: *Incisive Simplicity* – best explained as purity; *Intriguing Elegance* – a sense of depth that has emotional appeal; and *Seamless Anticipation* – part and parcel of traditional Japanese hospitality.

L-finesse also demonstrates Lexus's commitment to new human interface engineering concepts which can help provide the last word in luxury by anticipating passengers' requirements.

EXTERIOR DESIGN

The all-new fourth generation LS is longer and wider than its predecessor: overall length is up by 15mm to 5,030mm, but the wheelbase is longer by 45mm, at 2,970mm. Vehicle length from front axle to nose has grown by 40mm, while at the rear the distance from rear axle to tail is shorter by 70mm. The width has been extended by 45mm to 1,875mm and overall height is 1,465mm.

The LS shares a number of L-finesse design cues with the latest-generation GS and IS models in a strong and purposeful design that combines the *Incisive Simplicity* of sweeping lines with *Intriguing Elegance* of contrasting concave and convex shadow surfacing.

At the front the new LS is distinguished by its wide, horizontally latticed grille. The large, poly-ellipsoidal projector headlights are set at a higher level than the grille, helping to reinforce the car's dynamic appearance.

The design also makes use of the arrowhead shape, which can also be seen in the GS and IS. In the headlamp glazing this generates a strong coachwork line that sweeps seamlessly up to the A-pillar.

The arrowhead motif is a key element of L-finesse, expressing dynamism through a rapid but fluid change in direction. This and the 'slingshot' treatment of a number of exterior styling details are influenced by different elements of Japanese culture, from the brushwork of traditional calligraphy to the sweeping movement of a Samurai sword.

The LS's sidelights also adopt the arrowhead shape within the headlamp glazing, a detail that makes the car easy to identify, even after dark.

The proportions of the long cabin are also determined by L-finesse, with the base lines of the windscreen and the rear window proportionally equidistant from the vertical axes of the front and rear wheel hubs.

The blacked-out B-pillar emphasises the clean homogeny of the side glazing. This is framed by an elegant one-piece zinc moulding that also displays the arrowhead motif.

At the rear, the roof line flows smoothly into the surface of the boot lid. The belt line defines the upper edge of the large, wrap-around tail light clusters and ends at the top of the sharply truncated boot panel, which itself is deeply recessed into the bumper. The innovative exhaust design integrates the pipes seamlessly into the bodywork, neatly mirroring the arrowhead fog lamp and air intake detail in the front spoiler.

The design is aerodynamically efficient as well and, like the previous LS 430, the new LS 460 has a 0.26 drag coefficient..

A range of 10 colours is available, six of them new to the LS range.

EXTERIOR HIGHLIGHTS

The exterior design of the LS 460 is more than a pure style exercise, it represents the results of close co-operation between the Lexus Design Division, Lexus Development Centre and the Tahara plant where the car is built to realise the qualities expressed in the initial design sketches.

Front wing

The concave and convex shadow surfacing gives the front wing a complex profile that required a unique deep press moulding technique to be created. This has a pressing depth of 480mm at the top of the wheel arch, 60 per cent higher than the 300mm limit found in most standard production wings.

Paint finish

The LS 460 production line combines latest-generation robotised paint coating technology with hand polishing techniques by master craftsmen. The vertical surfaces are wet-sand

hand polished after each foundation coat, then checked by eye and digitally to ensure the best perceived quality. This is followed by wet polishing by hand of the entire foundation coat before the top, clear coat is applied, ensuring an unmatched quality of finish, both physically and visually.

To improve the durability of the paintwork, an acid rain-resistant coat is applied, in addition to a scratch-resistant coat for dark colours. The bumpers both have two layers of liquid clear coating.

Palladio Silver exclusively uses six coats of paint, four of which are baked. One layer incorporates minute particles of mica, carefully spread through a new coating technology to reduce glare, but offer a smooth, even and brilliant finish that gives particular depth and radiance to the coachwork.

Headlamp housings

The new poly-ellipsoidal projector headlights give the LS added presence thanks to the use of 125mm diameter polycarbonate housings. As the top end of the reflector reaches extremely high temperatures, careful consideration was given in the choice of housing and 11mm thick grey-tinted polycarbonate was selected, giving a crystal-like finish; in fact, the material has the same refraction index as crystal. Corner detail mouldings are hand-finished, inspired by the look of the finest hand-made crystal glassware.

Seamless door mouldings

The side glazing surrounds are fundamental to creating the elegant, sweeping profile of the new LS and they are finished in a seamless, integrated zinc die-cast moulding. This has varying section widths along its length and required Lexus to remodel its production equipment and revive an old manufacturing technique for injection moulding molten zinc that was used for the first generation LS 400.

To attain the high standards required for the LS 460, the engineers opted for a high-pressure injected casting. A high vacuum depressurisation system was adopted to instantaneously extract the gas formed at the same time as the zinc is injected, ensuring a high quality, cavity-free casting.

Again, the skills of master craftsmen have been called upon, to hand buff section areas that can’t be reached by robots and for the high precision of component fit.

INTERIOR DESIGN

The L-finesse quality of Seamless Anticipation is exemplified in the new LS from the moment you approach the vehicle and experience card or smart key access, easy door closing assistance and bespoke lighting that is sequenced as you get in or out of the car.

The interior design divides the cabin into four independent areas, the shape of the seats and architecture of the door trims giving a sense of each occupant being securely enveloped.

The material used to cover the dashboard is highly durable and is designed neither to shrink nor fade over time, even when the car is used in countries with very high levels of solar radiation.

A distinct horizontal division of the cabin, reinforced by the position of the front and rear armrests and corresponding detailing on the front seat backs, creates a strong sense of enclosure and security lower down, opening out into a lighter and spacious upper area.
The aesthetics of L-finesse are evident in many areas, including the top of the centre console and the fluidity of the leather seam line in the front door trim, which extends up to the belt line, following the contours of the passenger's body.

The door trim and dashboard give the interior a consistent appearance by using carefully matched materials that have the same grain and finish. The highest quality wood, leather and elegant metal highlights are used with unprecedented precision management of fit and finish throughout the cabin. Component gaps have been reduced by more than 50 per cent compared to the previous generation LS, in some cases down to as little as 0.5mm – a level that was previously unattainable.

The switchgear displays excellent ergonomics and tactile quality and is functionally intuitive. The profile of the centre console further reflects the attention to ergonomic detail: outer sections of the top of the centre cluster are flat, so that the control buttons can be seen clearly from both sides of the cabin; further down, these edges curve around the temperature buttons, which are independent for both front seat passenger and driver.

The surface of each button alternates between concave – for accurate use – and convex – for easy location on the console. And, demonstrating Lexus's attention to the smallest details, each lid on the console opens in the same direction and at the same speed, with consistent damping force, whatever the ambient temperature.

The excellent human-machine interface extends to the touch controls on the eight-inch Electro Multi vision screen, which displays 32,000-colour VGA graphics. The system is designed for user-friendliness, with no more than three steps needed to effect any command.

INTERIOR HIGHLIGHTS

Close attention has been paid to the design of all the controls and switchgear to ensure they are ergonomically positioned, have the right appearance and feel and even make a pleasing sound when operated.

Uniform control activation

The interior switches in the LS are not only grouped according to their function, but also require a different amount of pressure to operate. Thus, operating driving-related switches that are critical from a safety point of view requires greater pressure, with the level precisely matched across all such controls.

The operational speed and feel of the centre console, door pockets, coin case, glove box, ashtray, sunglasses holder, rear vanity mirror, assist grips and coat hooks have been matched to give the same opening speed with a consistent feel, minimal sound and a clean stop action. The centre console lid has a purely mechanical, semi-automatic opening and closing system for easier use.

Engineers investigated even the smallest cabin components in their efforts to isolate every potential source of unwelcome noise. Even the sound made by the door and boot lid closing has been addressed, with an emphasis on the lowest frequencies, a rapid sound cut-off and a reduced locking sound to reinforce the perception of refinement, strength and build quality.

Superior wood craftsmanship

The use of wood in the cabin demonstrates perhaps better than anything else the way in which Lexus combines the latest manufacturing technology with the expertise of master craftsmen. The ash burr, walnut and birdseye maple timber is sourced from sustainable plantations in Canada. The wood panels are laminated to an aluminium backing plate to ensure high rigidity before installation and are then finished with a multi-coating of lacquers to give a high-gloss and scratch-resistant finish.

Steering wheel leather

The four-spoke steering wheel is trimmed in a leather specially selected for providing the most wrinkle-free surface. Treatment of the leather has been redeveloped for the LS 460: it is now buffed twice and pressing time has been extended from one-and-a-half to three hours for better durability, feel and grip. The stitching pattern inside the rim has been changed from baseball to cross-stitching for better gap control and greater comfort. Particular attention has been paid to the area where the thumbs rest, with stitch pattern and position changed to make it less prominent and give a smoother feel.

Optitron instruments with colour multi-information display

A new LCD colour multi-information display is located in the centre of the instrument binnacle, between the Optitron speedometer, tachometer and fuel and engine temperature gauges. Four integrated monitor panels in the display provide the driver with a wide range of vehicle information quickly and efficiently, including a trip computer, individual tyre pressures, outside temperature, gear position, door and boot opening and cruise control. The display is also fully integrated with the vehicle safety systems, for example it flashes red and displays the BRAKE! message when the Advanced Pre-Crash Safety system detects an obstacle in front of the car.

The Optitron meters have a new design with a thinner construction, low-reflection paint and higher intensity LEDs for more uniform illumination and better all-round visibility. The luminosity of the Optitron meters and the colour multi-information display adjusts automatically to different peripheral light levels, for example when you drive into a tunnel or as day turns to night. This variation in luminosity moves through a series of graded increments, instead of just two as previously, allowing the instrument panel to adapt better to a wider range of ambient light conditions.

POWERTRAIN

The LS 460’s engine is the most advanced internal combustion unit that has yet been developed by Lexus. The 4,608cc 90-degree V8 is a completely new powerplant, every aspect of its operation having been re-thought from scratch.

Sophisticated production techniques and the skills of master craftsmen have produced a showcase of precision mechanical engineering that achieves world-leading performance in terms of refinement, quietness and durability.

The eight-speed automatic transmission is all-new, too, offering the widest gear spread in the segment to deliver competitive performance and class-leading economy.

4.6-litre V8 ENGINE

The new 4.6-litre V8 produces 35 per cent more power than its predecessor and between 10 and 30 per cent more torque across the entire engine speed range to give a class-leading balance of performance and fuel efficiency.

Construction and precision assembly

Lexus engineers set themselves the goal of optimum engine performance through minimising friction and the ultimate in precision assembly. They used comprehensive computerised design models and, for the first time, were able to digitalise the thermal deformation that takes place when an engine is running. This meant they were able to incorporate “real use” conditions into the design process, bringing new information to bear on several aspects of design and production.

To reduce the engine’s overall weight, the cylinder block is die-cast in a new lightweight, high-strength aluminium alloy. The block structure and rib reinforcement design were finalised by incorporating cylinder combustion pressure data to minimise noise and vibration. The head cover is made of a lightweight magnesium alloy to lower the engine’s centre of gravity.

Because cavity bubbles can form during the casting process, both block and cylinder head are checked before assembly using an X-ray inspection device and CT (computed tomography) scan, similar to those used in human diagnosis, to establish the size and number of any such cavities. This information supplements the data on thermal deformation to ensure that, for each engine, deformation occurs only within the precise parameters established at the design stage.

In order to achieve a significant reduction in camshaft weight and hence a reduction in the energy lost in rotating the shaft, a conventional, integrated casting was rejected in favour of a hollow, lightweight shaft with a separate cam lobe. The camshaft is cooled by liquid nitrogen before the cam lobes are attached, which allows a more exact cam profile to be machined, enhancing engine output.

Inside the cylinder block, care has been taken to eliminate variations in engine rotation due to discrepancies in cylinder wall resistance and fractional differences in the air-fuel mixture

delivered to each combustion chamber. Minimal resistance intake and exhaust pipes were developed to optimise combustion gas flows and, in place of conventional point location measurement, a bespoke, three-dimensional cylinder inner wall measuring device was introduced to ensure the gap between the cylinder lining and piston meets the strictest design parameters throughout the stroke cycle.

To minimise the friction generation when the vertical movement of the pistons is converted to rotational movement by the crankshaft and, hence, achieve an exceptional rotational balance, every area, including the contact points of the crankshaft and piston pins, is polished to a mirror finish. A burr removal system was developed to ensure oil is delivered smoothly throughout the engine, with minimal resistance. A high-pressure nozzle, which took six months to develop, delivers a smooth liquid with ultra-fine alumina particles that thoroughly polishes areas that couldn't be reached before, such as the lubrication holes in the crankshaft.

Greater precision in component manufacturing is matched by equally high quality engine assembly. New dual-arm robots were developed specifically for the LS 460 production line and a rigorous inspection process was drawn up to check assembly tolerances against the design parameters in every instance where high-precision parts are combined.

The V8 engine uses a new cooling technique called Partial Head Pre-cooling. Radiator coolant is fed into the cylinder head to cool the periphery of the combustion chamber. The heated coolant from the exhaust side – which tends to absorb the most heat – is then fed through the block's water jackets, achieving even heat distribution. This helps control deformation of the bore, reducing mechanical friction loss and contributing to better noise and vibration performance.

Thanks to this unprecedented application of technologies, the new V8 suffers less mechanical friction loss than other engines in its class.

Just before the final assembly steps, the engine is cranked by a motor to check for any unwarranted vibrations. Finally, the completed engine is tested under its own power: an accelerometer is mounted to the front and rear of the crankshaft to measure rotational differences under load and ensure the smoothest possible balance has been achieved.

Dual-pipe air intake system

To ensure the right air intake flow to support the increase in power, the new V8 has an over-the-engine dual-pipe intake system with compact air filter elements and an Acoustic Control Induction System (ACIS), a technology it shares with all other Lexus petrol engines.

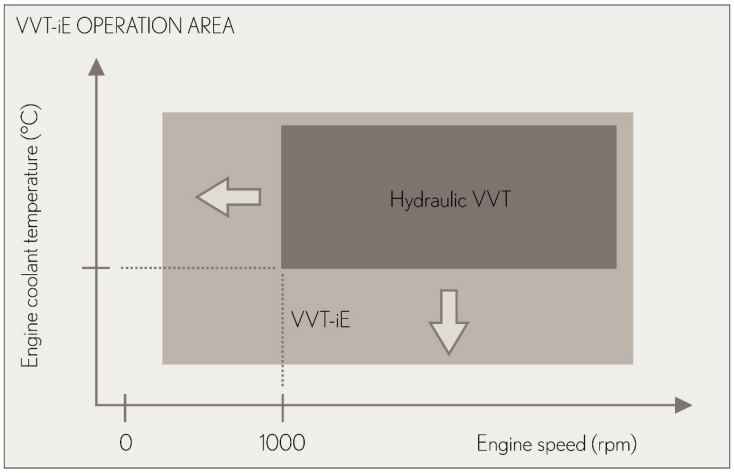
This high-speed, electric system varies the air induction by automatically adjusting the length of the intake pipe in line with engine speed, optimising the fuel-air mixture to help boost torque performance across the full rev range.

Lexus has eliminated the slight inconsistencies in air intake volume between the two cylinder banks that arise from using independent left and right intake ducts by adopting a single inlet design.

Dual VVT-i with VVT-iE for intake camshafts

The new engine uses Lexus's Dual VVT-i, a variable timing system which allows a greater overlap between the intake and exhaust valves, improving both low and high-end torque and contributing to a significant reduction in exhaust emissions.

The system uses the world's first electronically controlled, continuously variable valve timing system on the intake camshafts. Hydraulic variable valve timing cannot operate below 1,000rpm or when the engine is cold, but the VVT-iE system (Variable Valve timing – intelligent Electric) can operate across the full spectrum of engine speed and temperature, with a cam response speed of around 50 degrees per second towards the retard phase and 150 degrees per second towards the advance phase.



VVT-iE Operation Area

Great care has been taken in producing the motor's components, from the coil diameter, shape and optimum magnet position, to the uniform winding of the high-density coils to

ensure perfectly matched magnetisation within in each stator core. Precision milling of the motor shaft bearings further ensures that VVT-iE operates with negligible vibration.

Because of the cam phase shift that occurs when the engine stops, it is difficult to stop the cam at the best position for engine re-start using the electric motor alone. To counter this problem. Lexus has developed a mechanism that uses frictional resistance and speed reduction gearing to hold the cam phase in the ideal position for start up.

A high-precision finish plate and narrow pins are used at the interface of the speed reduction gear and phase converter to transmit the motor's particularly high rotational torque. The exceptional hardness of these elements requires special cutting and polishing technology. The required base cutting precision required is achieved using a scroll machine that has been designed using similar mechanics to a tool used for cutting air conditioner parts. A low air pressure grindstone is used to polish with a weak constant pressure, giving a mirror finish.

D-4S fuel injection system

The D-4S (Direct Injection 4-stroke petrol Superior version) injection system features two injectors per cylinder and is the latest evolution of Lexus's stoichiometric direct injection technology.

With one injector installed in the combustion chamber and the second mounted in the intake port, D-4S combines the strengths of both direct and port injection. It achieves exceptional engine efficiency throughout the power band and improves torque by 7.5 per cent across the rev range, while reducing fuel consumption and emissions. Compared to conventional direct or port injection systems, it also substantially reduces combustion fluctuations.

The port injectors have 12 holes that enable fuel to be injected at a maximum pressure of 4.0bar. The in-cylinder injectors have twin, 0.52 x 0.13mm rectangular slits to produce a double-fan 130bar injection pattern to achieve the most homogenous air-fuel ratio possible.

When starting from cold, D-4S employs port injection during intake and direct injection during compressions. The produces a lean, 15 to 16:1 air-fuel mixture, generating a richer mixture around the spark plug. This raises the temperature of the exhaust gases, which in turn enables quicker warm-up of the two thin-wall catalysts.

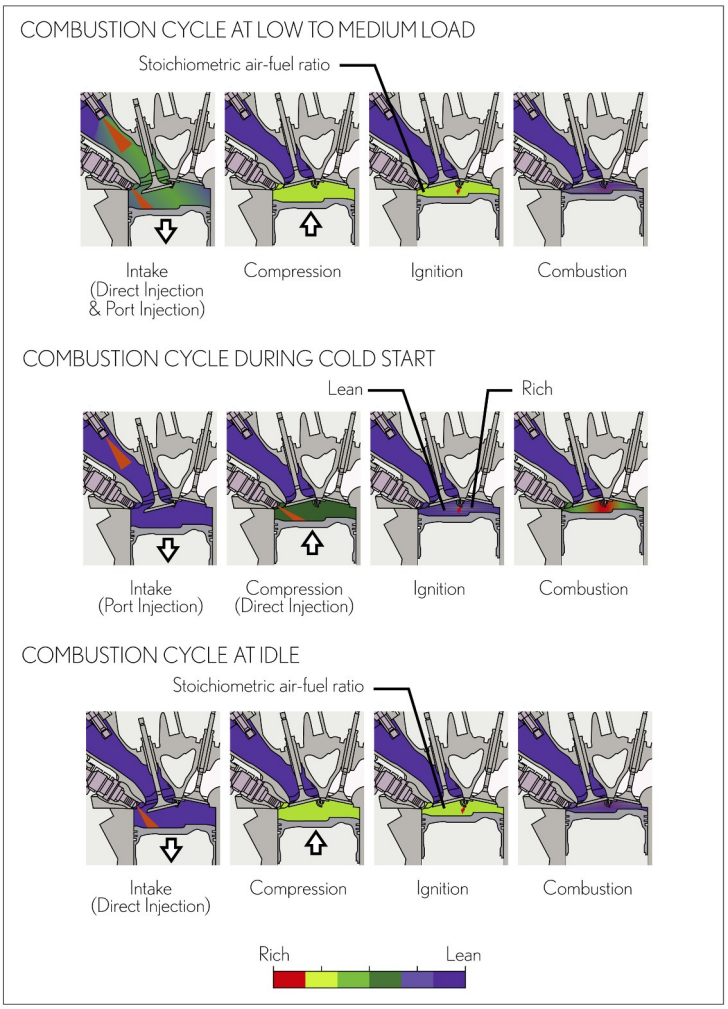
When idling, the engine runs on direct injection alone, because of its higher efficiency. When running under low to medium load, both direct and port injectors are used during the intake stroke, creating a homogenous 14.5:1 stoichiometric air-fuel ratio to stabilise combustion, improve fuel efficiency and reduce emissions of nitrogen oxides and hydrocarbons.

When the engine is running under heavy loads, the system again uses direct injection only. This achieves an intake cooling effect by injecting fuel directly into the combustion chamber, improving the efficiency of each charge. It also allows for a higher engine compression ratio of 11.8:1, reducing pre-ignition tendencies and improving engine output and performance. A 12 to 15:1 air-fuel ratio is effected during the intake stroke.

Semi dual exhaust manifold

The engine is fitted with a semi dual exhaust manifold to reduce interference in the exhaust gas flow, improve output and, hence, combustion efficiency.

The manifold connects non-adjoining cylinders, based on the ignition sequence, dividing the traditional single manifold into two, and merging mid-way. Connecting the cylinders with long injection intervals reduces exhaust counter-pressure interference and ensures a smooth flow of exhaust gases. In order to fit the new design within the confines of the engine bay, the exhaust pipe profile was modified to an ellipse, while maintaining the overall cross-sectional area.



Combustion Cycle at Low to Medium Load

Ultra-quiet running

Great care has been taken to ensure the new engine transmits the least possible noise and vibration to the cabin, maintaining the LS's reputation as one of the quietest cars in the world. Engineers focused on reducing noise and vibration by reducing friction in the engine parts, improving rotational balance and increasing the level of vibration absorbed by the engine mounts.

Extensive computer-aided engineering, incorporating thermal deformation data from a running powerplant, was used to develop the highest possible rigidity in the structure of the cylinder block and oil pan.

The precise location of the crankshaft within its journals delivers a high rotational balance. Even the angle of cross-hatched machining to the inner bore wall of the cylinder block has

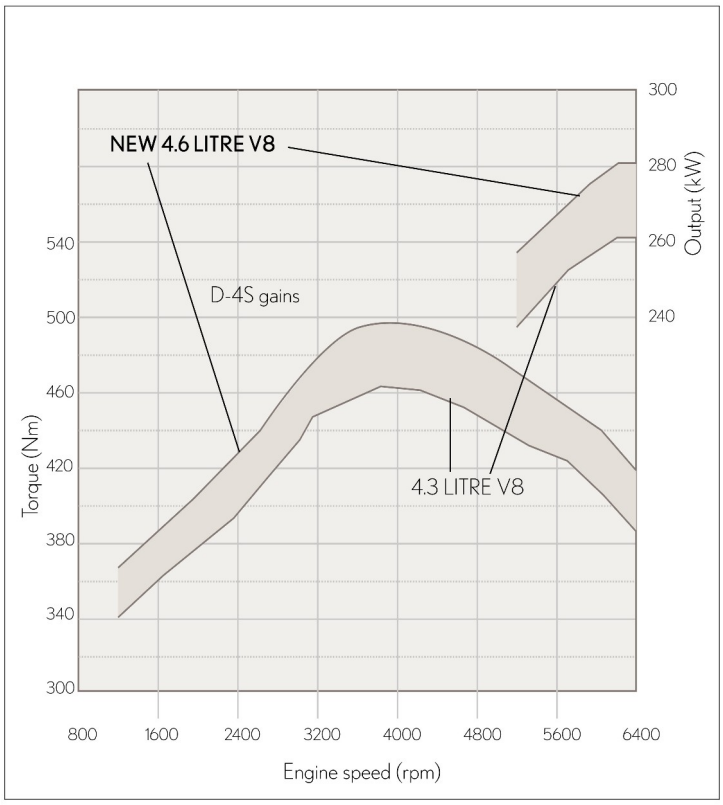
been optimised at 30 degrees to minimise transmission of vibration and provide better oil adherence.

Futhermore, to improve the air intake sound with reduced vibration through the new dual-pipe system, ribs have been incorporated in the air filter box wall, suppressing resonance. The space between the air filter and the engine head cover is plugged with urethane spacers to eliminate vibration being conducted from the engine.

And, finally, every engine is subjected to a detailed vibration check by a master craftsman, using a stethoscope to listen for any abnormal sounds. The technician will make any adjustments necessary to ensure each engine not only conforms to the exact design specification, but also has just the right tonal quality required for installation in the flagship of the Lexus range.

Performance

The new 4,608-cc V8 engine has a bore and stroke of 94 x 83mm; it develops 375bhp (380 DIN hp) at 6,400 rpm and maximum torque of 493Nm at 4,100rpm. It drives the rear wheels through the world's only eight-speed automatic transmission and will accelerate the LS 460 from nought to 62mph in 5.7 seconds and from 50 to 75mph in 4.7 seconds. Moving from rest to 400 metres takes 13.9 seconds. The top speed is electronically limited to 155mph. In spite of this performance fuel economy is good, the LS 460 achieving 25.4mpg in combined cycle driving. Carbon dioxide emissions are 261g/km.

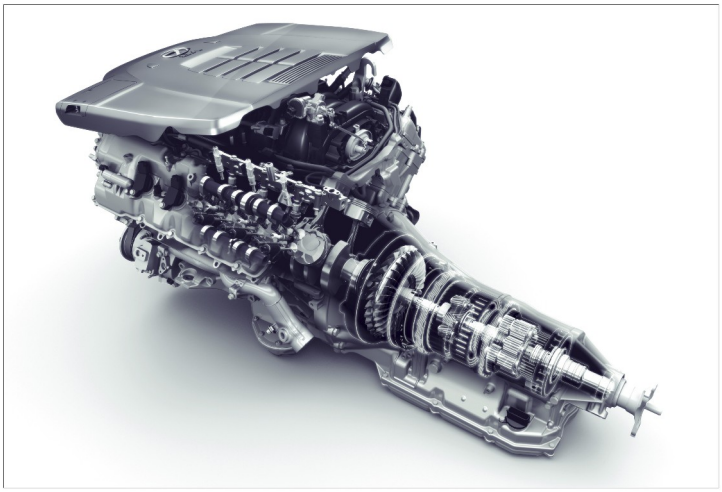


LS 460 v LS 430 Torque Comparison

Compared to rival V8 engines with larger displacement, the Lexus V8 with its new eight-speed automatic gearbox achieves class-leading performance and excellent fuel efficiency.

EIGHT-SPEED AUTOMATIC TRANSMISSION

The all-new eight-speed automatic transmission uses state-of-the-art electronics which simultaneously manage optimum gear selection and engine torque, helping the V8 engine achieve competitive levels of both performance and fuel economy.



Eight-speed Automatic Transmission

Construction

The transmission casing is a one-piece design, made of cast aluminium to keep weight down and maximise rigidity.

The unit's external dimensions are the same as the previous six-speed gearbox used on the LS 430, thanks to miniaturisation of parts, an improved hydraulic circuit with fewer components and a more efficient gear train. The new casing is 10 per cent lighter, yet 30 per cent stiffer than the six-speed and, although it only weighs 10 per cent more at 95kg, it has a 22 per cent higher torque capacity.

To ensure smooth handling of the V8 engine's 493Nm of torque, the precision and strength of the gear teeth has been improved. Micro-laser technology has been used to develop a polishing system that gives a perceptible improvement in the precision finish of the surface areas, while maintaining the necessary gear tooth thickness. As a result, gear tooth surface production tolerances have been reduced by about 50 per cent to give maximum torsional rigidity and a smooth, firm gear meshing action.

Using aluminium rather than steel for the surfacing has yielded significant weight savings. In addition, both the sun gear drums and the clutch hub are made of aluminium, reducing component weight by 50 per cent in each case.

Geartrain and hydraulic control

The eight-ratio geartrain comprises a double planetary gear seat and a Ravigneaux planetary gear set. This layout is complemented by four disc clutches, a single one-way clutch and two disc brakes. To guarantee the smoothest possible drive, the transmission can perform multiple gear shifts, rather than changes of just one ratio at a time, to make the most of torque under all load conditions. Moreover, whereas a conventional shift control releases one engagement clutch before the connection of a second, the eight-speed geartrain has been designed to transmit power through either one of the two engagement clutches at all times, minimising time lag and shift shock.

The hydraulic system combines the linear solenoid valve and control valve in a single unit. As well as contributing to the overall compactness of the unit, this design allows for a further significant reduction in gear changing times. At as little as 350 milliseconds, this is 41 per cent faster than the six-speed transmission in the LS 430 and is unmatched by any of the vehicle's segment rivals.

New hydraulic control system

Using a wider spread of gear ratios than any of its rival transmissions, the eight-speed automatic gearbox gives a class-leading combination of performance and fuel economy. Fuel efficiency is further helped by an extended cut in engine fuel injection during deceleration and expansion of the neutral control operation range. The Neutral Control System automatically decouples the engagements of the transmission in the 'D' position while the vehicle is idling at a stop, reducing engine load and improving fuel efficiency.

Minimal driveline noise and vibration

As there are no soundproofing materials in the driveline itself, great care has been taken to minimise noise and vibration through a combination of precision engineering, optimum operational balance and an innovative inspection system.

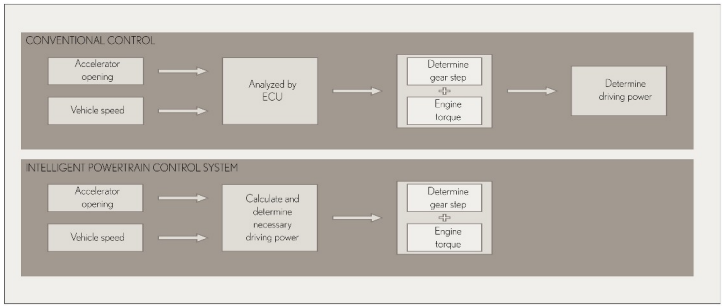
Extensive design analysis of the planetary gears showed that, when pairing gears with an identical number of teeth, sound pressure doubles due to noise resonance. But, by modifying the number of gear teeth, without affecting the total gear ratio, has significantly reduced the transmission of whine.

In addition to a marked increase in the precision of individual gear manufacture, the number of bearing positions and the surface area of each bearing have also been increased to ensure the best rotational smoothness and balance. Both the engaging precision of the differential gears and propeller shaft rigidity have been improved; the new three-joint propeller shaft, made to higher tolerances, features a flexible coupling with excellent noise and vibration performance.

As with the new V8 engine, the skills of master craftsmen are integral to the production process, from painstaking bench analysis to the fine-tuning of the sound vibration levels from each completed transmission when in operation. The rotational balance of the complete drivetrain is checked, as well as bending of the propeller shaft at high speeds and transmission whine from the differential gears, to ensure the driveline operates at a level no greater than 10dB.

INTELLIGENT POWERTRAIN CONTROL SYSTEM

Intelligent Powertrain Control is a feature unique to the Lexus LS 460, a new electronic management system that gives significant improvements in accelerator pedal control, linear power delivery and gear shift quality, while minimising torsion-induced propeller shaft vibration during acceleration.



Intelligent Powertrain Control System

The high-speed operational characteristics of the new automatic transmission mean there has to be the closest possible co-operation between the engine and the transmission's ECUs. Unlike conventional control systems, which rely on the independent communication of diverse ECUs with the throttle valve actuator (such as the transmission, engine, VDIM and Pre-Crash Safety system ECUs), Intelligent Powertrain Control analyses, prioritises and combines the demands of each system's ECU, centralising control of the throttle valve and ignition timing via the engine ECU.

This not only gives quicker and smoother gearchanges, but also yields quicker and more precise response to other ECU demands, such as those of the VDIM and Pre-Crash Safety systems.

BODY AND CHASSIS

The fourth generation Lexus LS has an all-new platform and bodyshell. Built with even greater precision than ever to the highest manufacturing tolerances, the body structure's weight balance, inertia moments and torsional rigidity have been honed for superlative ride comfort, high speed linear stability and superior chassis and steering response.

In a first for the segment, the front and rear multilink air suspension features an improved Adaptive Variable Suspension (AVS) system with vehicle posture control, which improves passenger comfort by synchronising vehicle roll and pitch when cornering. The LS 460 is also the only car in its class with electro-hydraulic braking, giving more precise brake force distribution and helping achieve optimum operation of the Vehicle Dynamics Integrated Management (VDIM) and other brake control systems.

The new, speed-sensitive Electric Power Steering (EPS) incorporates Variable Gear Ratio Steering (VGRS), which alters the steering gear ratio according to vehicle speed. This means minimum effort is needed when steering at low speed, with more feel and feedback

at higher speeds. The system is linked to both the AVS and VDIM as an aid to maintaining vehicle stability.

BODY STRUCTURE

The LS 460 has an ultra-stiff yet lightweight body, with torsional stiffness 30 per cent greater than the previous LS. Ultra-high tensile steel accounts for around 40 per cent of the steel body components, with different forms of the metal used in areas such as the front member, centre pillar, rocker panels and sides of the roof to reduce weight and improve collision safety performance.

The original LS 400 was the first car in the world to use high-precision laser welding and in the new LS 460 the application of this technology has more than doubled. This gives greater manufacturing accuracy and higher rigidity, which contributes to better steering response and feedback, better body control when cornering and less vibration when driving on poor surfaces. The bodyshell's torsional strength has been increased by using a combination of spot and laser welding in key areas.

There are a number of aluminium components, including the bonnet assembly, front and rear crash box structures and bumper reinforcements, rear axle carrier and front suspension sub-frame. The sub-frame was previously made from around 30 separate components, but on the new LS is a single, hollow die-cast unit that is machined at all mounting and location points to ensure it meets Lexus's precision tolerances.

AERODYNAMICS

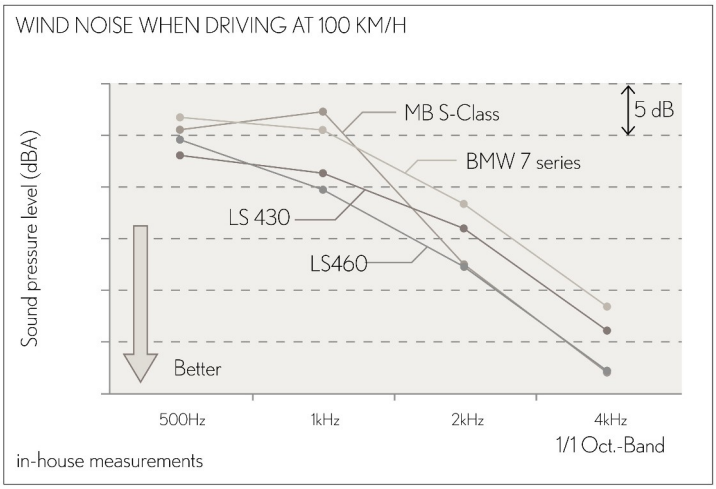
Seventeen years ago, the original LS 400 achieved a very respectable drag coefficient of 0.29. Each successive generation of the model has since achieved class-leading aerodynamics and the new LS 460 sustains this reputation with a 0.26Cd, making it the most aerodynamically efficient car in its segment.

The flowing bodywork has exceptionally narrow panel gaps and minimal protrusions. Flush bonnet, headlight and windscreen surrounds minimise breaks in the airflow over the car and the design of the door mirrors reduces air turbulence around the A-pillars. To the rear, the smooth convergences of the tapering waistline and sweeping C-pillars, and the integration of the twin exhausts into the profile of the rear bumper, ensure a clean passage of air, further reducing drag.

Adding a number of aerodynamic elements to the under-body creates a smooth, flat surface, improving high-speed stability and reducing wind noise. These include a deep front spoiler, side skirts, front and rear tyre fairings and covers for the cabin floor, transmission, fuel tank and rear suspension. Even the body attachment points have been designed with a flat seating, to minimise wind turbulence.

The fully flat central undercover has exceptional noise absorbing capabilities, particularly at higher frequencies, compared to the LS's direct competitors.

The car's handling also benefits from substantially improved front and rear lift coefficients.



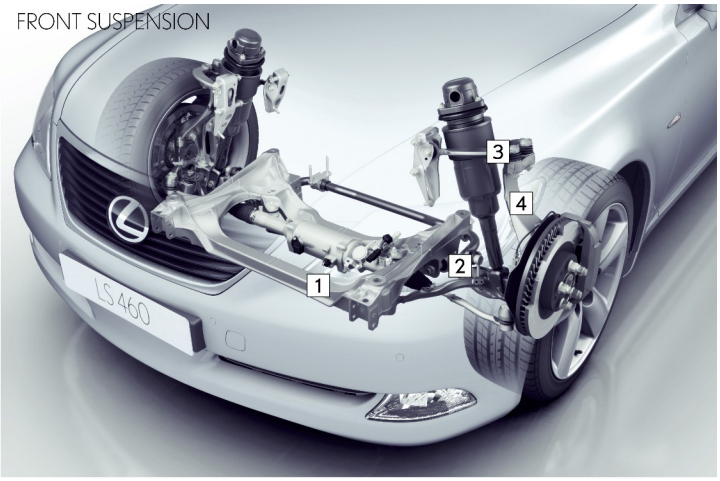
Wind Noise Performance Comparison

MULTILINK SUSPENSION

The LS 460 uses a multilink configuration for both front and rear suspension. Together with a track of 1,610mm – the widest in its class – and new high-performance pneumatic springs, this new format gives the car exceptional stability and steering feel, improves ride comfort and reduces noise and vibration from the unsprung mass.

Front suspension

At the front the LS 460 has a new-design upper and lower double joint system. Both upper arms, the knuckle and the lower rear arm are forged in aluminium, giving substantial weight savings. There are two key geometric features. First, an increase in the kingpin angle has improved jack-up torque within the forward-mounted steering gear; steering main shaft torque is greater than that in the previous LS 430, offering considerably prompter response to steering input. Second, the centre kingpin offset has been reduced by 26 per cent compared to the LS 430, giving a flatter ride and reducing the transmission of vibration from the tyre when braking.



ALUMINIUM COMPONENTS

1. Sub-frame
2. Lower rear arm
3. Upper arms
4. Steering knuckle

Rear suspension

The new multilink set-up at the rear combines stiffer component materials with a reduction in unsprung mass to provide better ride comfort and exceptional cornering stability. All five suspension arms, the carrier and pneumatic absorber upper support ring are made of aluminium.

The new geometry has been designed to generate a particularly linear toe-control curve, giving the highest level of straight line stability. In addition, using two, fully independent upper arms greatly improves the compliance steer response time of the tyres. The lower rear arm controls lateral forces and lower front arm longitudinal forces; both lateral and longitudinal forces are controlled by each of the upper arms.

Air suspension with AVS and Vehicle Posture Control

The suspension features new air springs which work in conjunction with an improved Adaptive Variable Suspension (AVS) system with Vehicle Posture Control to synchronise roll and pitch when cornering.

The air springs have 20 per cent greater air pressure, which gives sharper handling and better system response to changes in road quality. The revised design features a metal cylinder that limits expansion of the air bellow, improving high frequency ride comfort.

AVS gives the driver a choice of three damper settings, activated by a switch next to the gear lever: Normal mode for a flat ride; Sport mode for improved body control and precise

responses to steering input when cornering; and Comfort for a more compliant ride on uneven surfaces.

In any mode, AVS automatically adjusts the suspension performance on all four wheels independently. Data from sensors monitoring engine speed, wheel speed, steering, stop lamp operation, front and rear vehicle height and vertical acceleration is interpreted by a control computer. This then activates the appropriate actuator in each shock absorber, continuously adjusting the damping forces through nine incremental steps.

Thus, in response to driving operation, vehicle body motion and road surface conditions, AVS adjusts the damping force to fulfil a range of specific control functions: *vehicle speed-sensitive control* gradually increases damping force as speed rises, combining low speed comfort with high speed driveability and stability; *anti-dive control* increases front end damping force when braking to reduce front end dive; *anti-squat control* increases rear end damping force to minimise squat during acceleration; and *roll control* works to maintain vehicle posture and stability by adjusting damping force to both inner and outer shock absorbers through a bend.

The new Vehicle Posture Control logic is a feature unique to the LS 460. Incorporated in the AVS, it minimises the phase difference between roll and pitch angles during cornering by means of the adjustable dampers and so countering the discomfort a passenger might experience as the car negotiates a bend.

The AVS's Semi-Active Control provides independent control of all four shock absorbers to achieve the best damping force in response to changes in the road surface.

When the driver selects the AVS system's Sport mode, the difference between inner and outer shock absorber damping through corners is increased by about 20 per cent to reduce body roll further. At the same time, VGRS reduces the steering gear ratio by around 10 per cent and the EPS increases steering assist torque by four per cent. These measures combine to reduce body roll, sharpen handling and improve steering feel.

EPS WITH VARIABLE GEAR RATIO STEERING

The LS 460 is the only car in its segment to be fitted with high-power speed-sensitive Electric Power Steering (EPS), featuring Variable Gear Ratio Steering (VGRS). This compact, lightweight, electrically assisted system is noise-free and gives seamless, linear feedback, smoothly changing its assistance characteristics in line with vehicle speed. It is

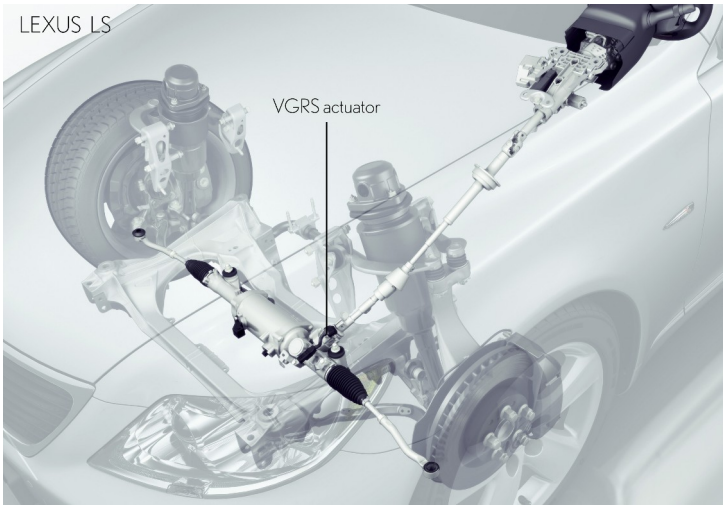
also a key element in the performance of the Vehicle Dynamics Integrated Management (VDIM) and the Pre-Crash Safety system's Emergency Steering Assist and Lane Keeping Assist functions.

The new EPS was designed specifically to suit the LS 460's multilink suspension with both 18 and 19in tyres. It uses a new step-up DC-DC power converter that increases voltage to 46V and a bespoke 100mm diameter high-output brushless motor. The smooth running motor delivers about double the output of a conventional power steering unit, but is only 25mm wider in diameter than the one used in the previous generation LS.

Using a new high rigidity steering intermediate shaft and a slider joint with zero rotational clearance gives the LS 460 exceptionally smooth and direct steering feel with agile and linear yaw response and detailed feedback. It gives the LS a minimum steering ratio of 11.7:1 (with 19in tyres), compared to 16.4:1 for its predecessor model.

The VGRS uses an actuator attached to the steering rack that alters the ratio according to vehicle speed, by up to 30 per cent, representing a 130-degree phase in steering wheel angle. At very low speeds the steering gear ratio is at its lowest, requiring 2.5 turns lock-to-lock and reducing the effort required for tight cornering and parking manoeuvres. At medium speed the ratio is optimised for accurate vehicle response when cornering and at high speed (with 3.6 turns lock-to-lock) is ensures gentle response to inputs to maintain vehicle stability.

The VGRS actuator is also linked to the VDIM control system. As the LS 460 nears the limit of its performance capabilities, the system constantly re- evaluates the steering gear ratio to achieve the best front wheel steering angle to help maintain stability with minimum driver input.



VGRS Actuator

VGRS also works with the Emergency Steering Assist system to provide quicker steering response when an obstacle is detected in front of the car.

As well as the numerous technical adjustments made to improve steering feel and response in all conditions, Lexus engineers have also worked to make the LS 460 the most manoeuvrable car in its segment, as demonstrated by its class-leading 5.4-metre turning radius.

ELECTRONICALLY CONTROLLED BRAKING AND BESPOKE TYRES

The LS 460 is the only car in its segment with an electro-hydraulic braking system. This not only reduces the overall weight of the brakes, but gives more precise brake force distribution, which in turn supports the most effective operation of the VDIM.

The Electronically Controlled Braking (ECB) system features 357mm discs at the front and 335mm discs at the rear, both with spiral fin ventilation and high grip coefficient brake pads to increase judder-free high-speed braking efficiency.

The system gives unparalleled stopping power with front four-pot callipers and rear two-pot callipers, all made of lightweight aluminium. The contact area of the front pad is 24 per cent greater than on the LS 430 and the thickness of both front and rear pads has been increased by 23 per cent.

The ECB has a new ECU with greater processing speed than the one currently used in the Lexus GS 430. The revised system improves the control precision and responsiveness of the brake hydraulic pressure. Pedal feel is also improved.

With the ECB system, independent hydraulic braking power is applied to each wheel. Once engaged, a sensor detects the amount of forces being applied to the brake pedal and the hydraulic braking power is then calculated and applied to the individual wheels as necessary.

The development of the system focused not only on achieving the best ABS performance, but also on tyre grip. Working with Lexus engineers, tyre manufacturers tested two to three times as many prototypes in order to achieve the required grip, in line with steering feel, ride comfort and low noise and vibration performance appropriate for Lexus’s flagship model.

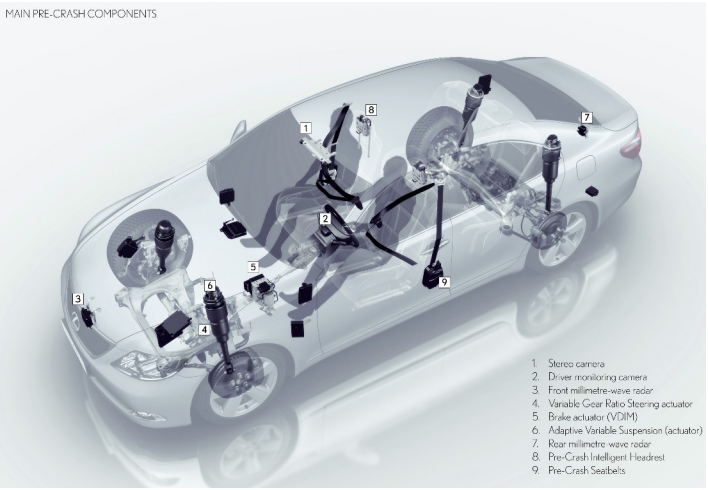
SAFETY AND DRIVER ASSISTANCE SYSTEMS

The new Lexus LS 460 offers the highest content of sophisticated preventive, active and passive safety technology in the world. It also benefits from a series of world and segment-first features, both for safety and for making driving easier and more enjoyable.

The Advanced Safety Pack comprises Adaptive Cruise Control, Advanced Obstacle Detection, Rear Pre-Crash Safety system, driver monitoring system, Emergency Steering Assist, Lane Keep Assist and Lane Departure Warning. It is provided as standard on the LS 460 SE-L and is available as an optional upgrade pack on the LS 460 and LS 460 SE.

ADVANCED PRE-CRASH SAFETY SYSTEM

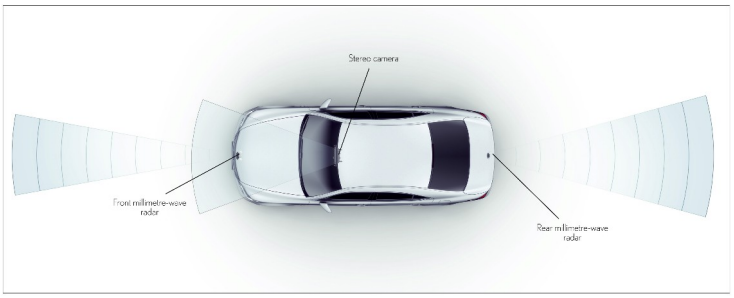
The new LS 460 takes anticipatory, preventive safety to new heights, introducing four world-firsts in the field. It provides an unprecedented combination of safety features that can detect potentially dangerous situations in advance and help the driver reduce the risk of an actual collision, or the consequences should the worst happen. The advanced technology ensures excellent protection not only for occupants, but for pedestrians, too.



In a significant development of the sophisticated Pre-Crash Safety system (PCS), Lexus engineers have incorporated new features that anticipate and automatically react to several different types of impending collision.

Advanced Obstacle Detection system

Subject to weather conditions, the Advanced Obstacle Detection system can pick out a wide range of obstacles in the path of the LS 460 by day and night, including, for the first time, pedestrians.



Advanced Obstacle Detection and Rear Pre-crash Safety Systems

The system combines information from a millimetre-wave radar and a near-infrared stereo camera. The camera consists of two near-infrared lenses mounted 350mm apart at the top edge of the windscreen. Radiation generated by dedicated emitters built into the high-beam headlight projectors is detected by the camera when reflected off objects directly ahead of the car, even those that are hard to detect, such as pedestrians, at a range of up to 25m, even after dark.

Emergency Steering Assist

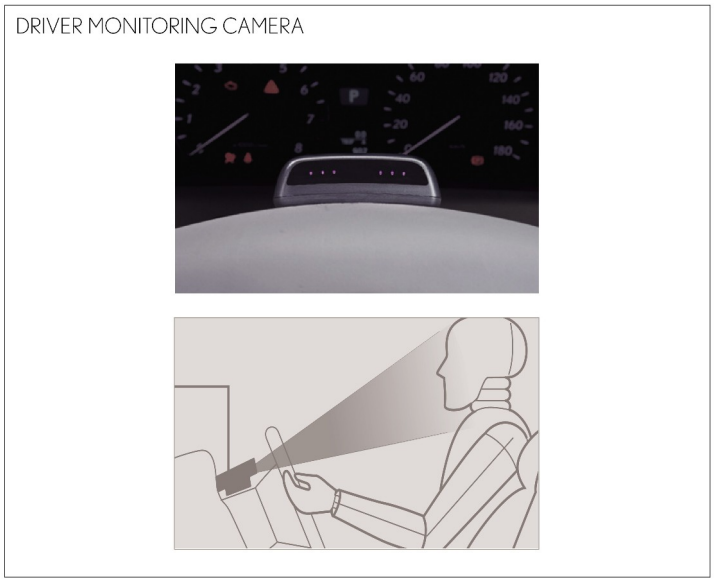
The Emergency Steering Assist system improves the vehicle's response to driver steering input, selecting the best gear ratio for rapid evasion manoeuvres and thus increasing the chances of avoiding a collision. It works through close interaction between the car's Variable Gear Ratio Steering (VGRS), Vehicle Dynamics Integrated Management (VDIM) and Adaptive Variable Suspension (AVS) systems.

The VGRS actuator, which is attached to the steering rack, reduces the steering gear ratio to provide more direct steering and improve response to driver input. At the same time, the AVS adopts a stiffer damper setting to minimise body roll and optimise chassis balance. The VDIM governs selective brake control, to control the vehicle's yaw rate, allowing for quick changes of direction without threatening the car's overall stability.

Driver monitoring system

The new LS 460 is equipped with the world's first driver monitoring system, designed to warn of dangers ahead if the driver takes his or her eyes off the road.

A CCD (charge-coupled device) camera is mounted on top of the steering column cover with six built-in near-infrared LEDs which allow the system to work accurately both day and night.



When the vehicle is started up, the system automatically plots the position of the driver's facial features – eyes, nose and mouth – and measures the width and centre line of the face. This information is used as a reference as the system monitors movement of the driver's head from side to side.

If the driver's head is turned away from the road ahead while the vehicle is moving and an obstacle is detected in its path, a pre-crash warning light and buzzer are activated. If the situation persists, the brakes are briefly applied to alert the driver. If this still fails to prompt action from the driver, the PCS engages emergency braking preparation and pre-tensioning of the front seatbelts.

Before being put into production, the system was tested with more than 100 drivers, covering more than 100,000km. As long as the driver's face is in the clear sight-line of the camera, it will function accurately, regardless of the driver's seat position, facial characteristics, or if sunglasses are being worn.

Pre-Crash Safety – operating sequence

When the Advanced Obstacle Detection System identifies obstacles ahead, the Pre-Crash Safety system assesses the likelihood of collision based on the position, speed and trajectory of the obstacle, If the collision probability is high, a warning buzzer and red BRAKE! alert on the multi function display are activated.

After testing the reactions of a number of drivers, Lexus engineers determined the best engagement timing for all PCS functions, to improve the chances of the driver reacting in time to prevent the collision happening.

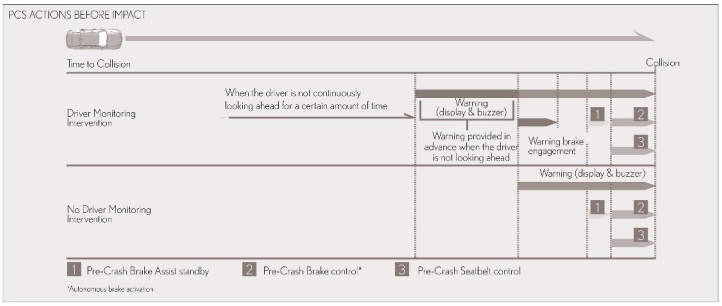
To help avoid an impact, PCS automatically activates a series of integrated safety systems:

- Pre-Crash Brake Assist: system is put on stand-by to give maximum brake pressure the moment the driver presses the brake pedal.
- Emergency Steering Assist: improves the steering response to driver input.
- Adaptive Variable Suspension: stiffens the dampers, controlling nose dive when pre-crash braking is engaged, and increasing the car's responsiveness to evasion steering.

If the system determines a collision cannot be avoided, it activates the Pre-Crash Seatbelt: the front belts are pretensioned, with any slack taken up to maximise initial restraint performance. Pre-Crash Brake Assist automatically engages the brakes to reduce vehicle speed at the point of impact.

On a dry, high grip road surface, the maximum deceleration achieved by the Pre-Crash Brake is between 0.6 and 0.7G (6 and 7m/s). Internal Lexus testing has revealed that intervention by the system can substantially reduce impact energy.

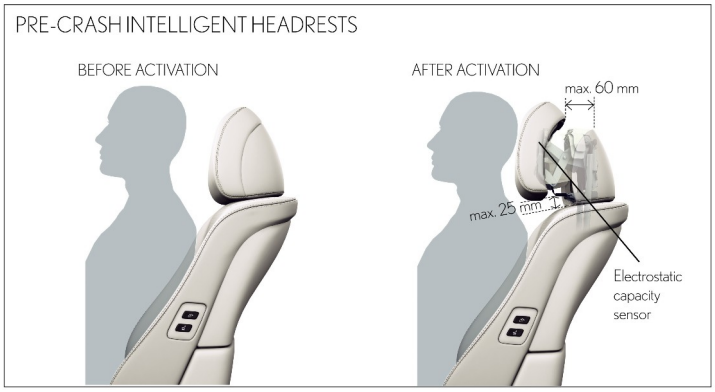
Pre-Crash Seatbelt pretensioners are also activated if the vehicle's yaw rate goes above a certain threshold at speeds of more than 9.5mph (15km/h).



Pre Crash Safety System Functions

Rear Pre-Crash Safety system

The LS 460 features the world's first Rear Pre-Crash Safety system, using a millimetre-wave radar set into the rear bumper. This constantly scans the area around the back of the car, both when the vehicle is on the move and when parked.



Pre-crash Intelligent Headrests

If a collision is calculated to be unavoidable, the system activates the front seat Pre-Crash Intelligent Headrests. These move up to 60mm forwards and 35mm upwards to cushion the head in anticipation of an impact, greatly reducing the risk of whiplash injury. The headrests are fitted with a sensor that measures the distance between the passenger's head and the headrest itself, so there is no risk of the emergency adjustment itself causing substantial contact. The system does not operate if the seat is unoccupied.

ACTIVE SAFETY

The LS 460's comprehensive active safety equipment package includes two segment firsts: Lexus's Vehicle Dynamics Integrated Management system (VDIM) and Variable Gear Ratio Steering (VGRS). These key Lexus technologies establish an unprecedented link between the vehicle's active and preventive safety measures.

Vehicle Dynamics Integrated Management

The new LS 460 is equipped with the latest evolution of Lexus's Vehicle Dynamics Integrated Management (VDIM) system, to improve performance, traction control and vehicle stability. VDIM integrates the Electronically Controlled Braking (ECB), ABS, Electronic Brakeforce Distribution (EBD), traction control (TRC) and Vehicle Stability Control (VSC) active safety systems with the vehicle's Adaptive Variable Suspension (AVS), Electric Power Steering (EPS) and Variable Gear Ratio Steering (VGRS).

VDIM in the LS 460 goes one step further by achieving – for the first time in any stability control system – full co-operation with the powertrain. The Powertrain Control System enables VDIM to interact with both the engine and transmission, employing throttle and gear ratio control to achieve a faster, smoother and more precise response in situations where there is a risk of losing traction. For example, when driving on a slippery road, VDIM will command the transmission to perform an upshift at a lower engine speed, in order to avoid a possible loss of stability.

VDIM was the first stability control system on the market to fully integrate all these functions in a single package. Where a conventional system can only govern one active safety function at a time – with potentially significant time delay implications – VDIM gives simultaneous commands to all appropriate systems, giving independent wheel control to keep the vehicle safely on course.

In addition, where conventional systems are only activated when a vehicle exceeds the limits of its performance, VDIM triggers control functions in stages before that limit is reached. This is made possible by a built-in ECB actuator, which can control the hydraulic brake pressure on each wheel independently and progressively. The result is smoother, less abrupt performance.

VDIM can also adapt to the use of snow chains and winter tyres by reading the road conditions and acting accordingly to minimise loss of grip.

Communication between VDIM and the other body control systems is carried out via a large-capacity network. Creating an adequate control logic has been crucial in developing the latest version of VDIM. Continuous compatibility tests were undertaken right up to the final development stage of each control system; reliability test programmes, spanning thousands of different patterns, were incorporated in the VDIM ECU; and the number of test cycles was substantially increased. Finally, several long-run tests were conducted in different countries to ensure the robustness of the electronics.

Variable Gear Ratio Steering and VDIM co-operation

The LS 460's Variable Gear Ratio Steering (VGRS) uses an actuator attached to the EPS gear housing to alter the steering gear ratio in line with vehicle speed. At very low speed, the ratio is at its lowest (11.7:1, with 19in tyres) to reduce the steering input and effort required for tight cornering and parking manoeuvres. At medium speeds the ratio adjusts to give accurate vehicle response when cornering. And at high speed the ratio is at its highest (16.7:1 with 19in tyres) to give gentle response to driver inputs.

VGRS co-operates fully with the VDIM system in order to give the quickest and most appropriate steering response possible in a range of different conditions where there is a risk of the vehicle's stability being compromised. For example, on a road where there is a different level of grip on either side of the vehicle, sudden braking will cause the car to pull to the side with the most grip. As well as optimising the efficiency of the ECB system, VDIM

simultaneously activates the EPS and VGRS systems to automatically regulate the steering angle and counteract the uneven left and right-side braking forces, minimising the amount of input the driver has to make to maintain straight-line braking.

Similarly, when different degrees of grip cause the vehicle to pull under acceleration to the side with the least grip, VDIM regulates the steering angle to maintain stability, again reducing the degree of input demanded of the driver.

Should oversteer occur, VDIM activates independent wheel brake control through the ECB and, in conjunction with the EPS and VGRS, engages a counter-steer function to help the driver control the vehicle's direction. In such conditions, the combined use of braking and steering control causes less deceleration than traditional braking systems, giving smoother performance.

In cases of excessive understeer, the VGRS, with steering torque assistance from the EPS, automatically prevents excessive steering and works with the VDIM system's engine output and brake control to maintain vehicle stability.

In all the above scenarios, the VDIM uses the VGRS and EPS to help the driver make the appropriate steering input to deal with any situation and keep the vehicle under control. Simultaneous VDIM control of the Adaptive Variable Suspension (AVS) automatically regulates shock absorber rates to improve body control in extreme conditions and reduce the amount of vehicle nose dive under emergency braking.

Electronically Controlled Brake (ECB) system

The LS 460 is the only car in its segment to feature an electro-hydraulic braking system. The adoption of electronic control brings down the overall weight of the system and allows for more precise brake force distribution and closer co-operation with other related systems, which in turn benefits the performance of VDIM.

ECB uses a new ECU with a much faster processing speed compared to the one used on the Lexus GS 430.

PASSIVE SAFETY

The LS 460 has been created with the clear aim of achieving class-leading safety in terms of frontal, off-set, side and rear collisions. Internal testing shows it has the potential to achieve

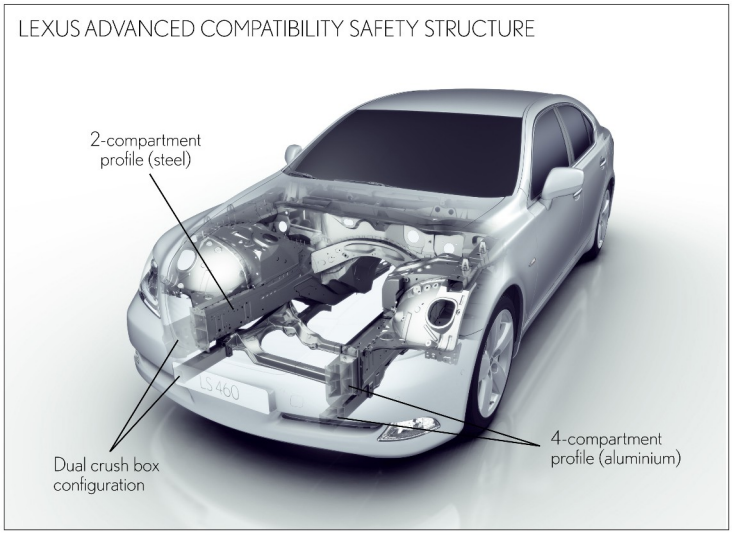
the maximum five-star rating for adult passenger protection in the independent Euro NCAP crash test programme.

Safety structure

In line with Lexus's unique, stringent car-to-car impact compatibility standards, the LS 460 has been developed using the Lexus Advanced Compatibility Safety Structure. This is an all-new, highly rigid platform with a robust safety structure capable of absorbing a high degree of impact energy.

A larger quantity of ultra-high tensile steel is used in the body to produce a lighter structure with greater stiffness that can absorb more energy. The frontal energy absorption structure combines an aluminium crash box with a lower aluminium member, which is an extension of the crushable front suspension member. Careful positioning of plates to create compartments within these two elements optimises load distribution, ensuring even deformation. Energy absorption is increased by reducing the buckling of the crash box walls that usually occurs during a collision.

Working together, the main crash box and the ancillary lower member not only improve occupant protection but also give the LS 460 a higher collision compatibility with smaller vehicles and even pedestrians. Impact load is distributed and absorbed over a wider surface area in different types of collision, reducing the damage to the other party. The lower member helps prevent the LS riding up over smaller vehicles and reduces the risk of a pedestrian's legs becoming trapped under the car.



Pedestrian protection performance has been improved by a 30 per reduction in the size of the air filters mounted on top of the engine. This ensures there is the right amount of space

between the engine and bonnet to allow for deformation of the bonnet when an impact happens.

The highly rigid bodyshell has numerous structural reinforcements to enhance collision performance. Extensive bracing in the floor gives better torsional rigidity and the use of specific materials in key areas keeps overall vehicle weight down while ensuring high skeletal strength.

Comprehensive car-to-car side impact testing at 34mph (55km/h) revealed how localised deformation was reduced thanks to impact energy being dispersed over a wider area.

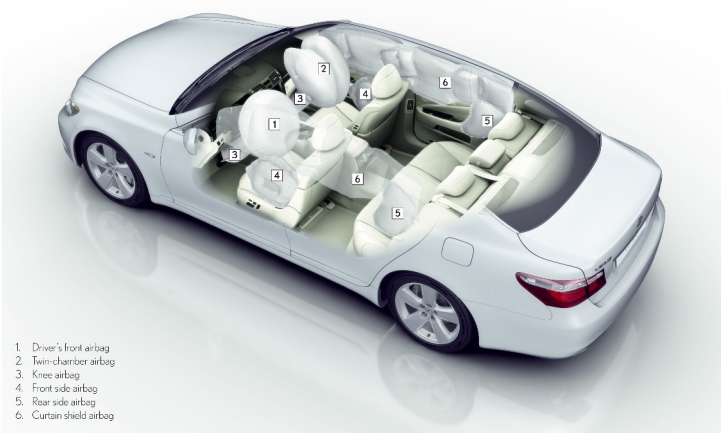
Airbags

The LS 460 has the most comprehensive range of airbags in its segment: two front airbags, with a twin-chamber airbag for the passenger; driver and front passenger knee airbags; front and rear side airbags; and full-length side curtain airbags.

Both front airbags have a dual-stage operation. Sensors determine the severity of an impact and deploy the airbags with the appropriate force. There is also a passenger detection system, which prevents any of the passenger airbags being triggered if the seat is unoccupied.

The knee airbags not only protect the occupants' knees, but also work with the front airbags and seatbelts to achieve a better distribution of the loads imposed by the safety restraint systems on the body during severe impact deceleration.

Crash sensors are located in the car's B and C pillars, which means side and curtain airbags can be activated as quickly as possible and also enables the system to assess more accurately which airbags need to be deployed in any given impact.



Airbag System

The twin-chamber passenger airbag is available for the first time in this segment, its shape based on the Lexus Omni-Support concept. Once inflated, the twin chambers create a depression in the centre of the airbag which effectively cradles the face while allowing the physical impact of the bag to be dispersed across other parts of the head, shoulders and upper body.

DRIVER ASSISTANCE SYSTEMS

The LS 460 is equipped with a series of innovative driver assistance systems, designed to make life on board simpler and safer. A Lane Keeping Assist system helps the driver maintain the correct position on the road; Intelligent Parking Assist helps with both parallel and series parking manoeuvres; and a Brake Hold function makes control of the car easier in frequent stop-start traffic.

Lane Keeping Assist (LKA)

The Lane Keeping Assist (LKA) system is a first for the European luxury car market. It is provided as standard on the LS 460 SE-L and is also available as part of the optional Advanced Safety Pack for the LS 460 and 460 SE models.

Subject to road and weather conditions, the system monitors the white line markings on the road using the car's stereo imaging camera and determines when the vehicle is drifting out of its lane. It will then sound an alert and provide steering assistance to help the driver bring the car back into line.

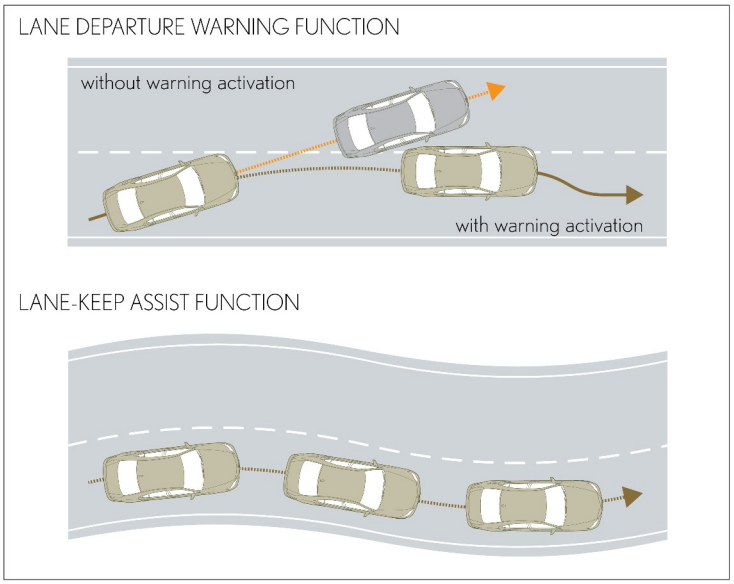
The system is activated by the driver and has two functions, depending on whether or not the Adaptive Cruise Control is operating at the same time. If the ACC is switched off, the

system provides a Lane Departure Warning (LDW) function only. Working at speeds above 31mph (50km/h) and within a lane width of three to four metres, LDW detects a risk of lane departure one second ahead of it happening. It encourages the driver to steer back into lane by activating a warning light and sound and providing brief and pronounced corrective steering force. The system does not operate if the driver has activated the car's indicators.

When ACC is operating, LKA further provides a Lane Keep (LK) function. This works at speeds between 47 and 106mph (75 to 170km/h) and within the same lane widths as LDW, above. Like LDW, LK uses an audio-visual warning display on the instrument panel and also provides continuous steering torque to help the driver re-centre the car in its lane. The driver should keep active control of the steering at all times and can override the system's torque output, simply by using a little extra steering effort, comparable to that required when parking.

In addition, by monitoring the driver's steering input, LK automatically deactivates if it detects hands-free driving for a period of more than 15 seconds in a straight line, and five seconds when cornering.

LKA indicates either of its two operating modes on the multi-information display, using lane marker and steering wheel symbols. Once activated, LKA in LDW mode displays framed lane marker lines until lane detection has been achieved, at which point the markers appear as a solid, bold line. If at any stage lane detection is not possible, the markers automatically revert to framed line status. When the LK function is operating, LKA displays the lane marker lines and a steering wheel sign, together with the vehicle speed at which the ACC is set.



Intelligent Park Assist

Like the Lane Keeping Assist system, the Lexus Intelligent Park Assist (IPA) is offered for the first time in the luxury segment. Similarly, it is provided as standard on the LS 460 SE-L and as part of the optional Advanced Safety Pack.

The system can help the driver negotiate parallel or series (side-by-side) parking spaces, using a rear camera and ultrasonic sensors to identify a suitable space and then calculate the correct steering angle required to guide the vehicle safely in. Following confirmation from the driver, the system controls the steering automatically to move the car into the targeted parking position. The driver doesn't have to steer the vehicle, but has to use the throttle and brake, keeping speed to a maximum of 2.5mph (4km/h).

The rear view camera is mounted next to the rear number plate and the two sensors are mounted one each side of the front bumper. When parallel parking, the driver drives slowly past the chosen space, enabling the sonar sensors to detect it, then stops just beyond the space in the usual way. After reverse gear and the parallel park option have been selected, the IPA control unit calculates the appropriate vehicle path and steering angle and projects a view of the target parking position on to the EMV touch screen on the centre console. The driver then confirms acceptance of the target position and system activation. At this point, when the driver releases the brake pedal, the vehicle will begin to reverse slowly. Using the drivetrain and brake system ECUs to monitor vehicle speed, the system automatically controls the Electric Power Steering to guide the car into place.

While the system controls the steering in both manoeuvres, the driver is responsible for controlling speed and stopping the vehicle. The IPA can be deactivated at any time during a manoeuvre, by either throttle or steering inputs.

Brake Hold

With the Brake Hold standby switch activated, Brake Hold is engaged when the vehicle comes to a halt, automatically controlling the hydraulic brake pressure of each wheel and obviating the need for the driver to maintain pressure on the brake pedal.

Brake Hold is controlled by the Electrically Controlled Braking ECU and works in conjunction with the electric parking brake. The parking brake automatically engages during Brake Hold if the driver gets out of the vehicle, if the bonnet or boot are opened, or if a significant time has passed since the system was activated.

To restart the car after a temporary stop with Brake Hold engaged, the driver simply has to operate the accelerator.

COMFORT, CONVENIENCE AND ENTERTAINMENT

Comfort, convenience, discreet hospitality and carefully considered driver interaction are at the heart of the Lexus ownership experience and the LS 460's interior expresses these qualities in a class-leading array of technologically advanced equipment designed to simplify and enhance life on board. The scene is set from the moment you approach the vehicle, through the handy card key access (SE and SE-L), easy door-close, power boot lid (SE and SE-L), bespoke sequenced lighting that operates as driver or passengers enter or leave the vehicle, and push-button engine start-up.

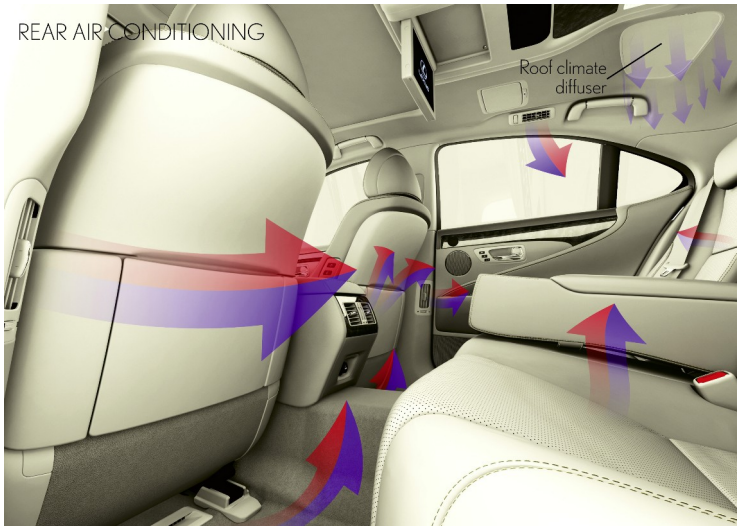
All LS 460 models are generously equipped with high-quality features, including laminated front and side window glass, air conditioned front seats, high-speed satellite navigation system with traffic avoidance technology, an eight-inch Electro Multi-Vision VGA display with touch-screen controls, and a voice command system to control the audio, air conditioning, navigation and Bluetooth wireless phone functions. The LS 460 is also the only car in its segment to fit a Parking Assist Monitor as standard on all models.

FOUR-ZONE AIR CONDITIONING WITH ROOF CLIMATE DIFFUSERS

The rear seat upgrade package (standard on SE and SE-L) includes an air conditioning system with four-zone independent climate control. It provides independent left and right control for both front and rear seats, as well as automatic control of the upper and lower cabin air zones, managing not only temperature, but also choice of outlets and airflow volume.

Full range of air outlets for efficient climate management

There are 20 separate outlets for distributing warm or cold air in the LS 460's cabin. As well as B-pillar outlets, rear seat passengers benefit from the world's first Roof Climate Diffusers. Mounted above each outer rear seat, these are generously proportioned and offer unparalleled climate control around the head and neck. By diffusing low-volume, fresh cooling air directly behind the passengers' heads, the Roof Climate Diffusers counteract the effect of solar heat absorbed through the rear window and roof, something that is beyond the capacity of conventional roof or B-pillar outlets.



Four-zone Rear Air Conditioning

High output system and independent rear climate control unit

The LS 460 uses a high output climate control system, designed to quickly generate and maintain the desired interior climate and tested to excel in even the most extreme weather conditions.

The maximum air flow volume to the cabin in heating mode when driving is 535m^3 per hour (642kg/h). The independent rear climate control unit increases the volume to 635m^3/h (762kg/h) and adds 1,100W of cooling power.

This powerful system uses a variable-displacement compressor, which means it operates only as needed and, thus, more economically.

Complete sensor network with pollen removal mode

The climate control system uses up to 13 sensors (with rear air conditioning unit) to monitor climatic conditions. There are three outflow temperature sensors for the different zones (one at the front, two at the rear), two front face duct sensors, an external temperature sensor, two solar sensors for the front and rear seats, and a pressure sensor, plus front and rear cabin evaporation sensors that help prevent the sore throat feeling that conventional air conditioning can cause.

The four-zone system also has a pollutant sensor that measures the levels of nitrogen oxides, carbon monoxide and hydrocarbons in the air outside. Whenever the concentration of these pollutants rises above a set threshold, the system will automatically switch to recirculation mode.

When in fresh air mode, two combined filters are in permanent use. These absorb pollutants, intercept plant pollen and dust particles and reduce odours. In addition, a Pollen Removal Mode switch activates air recirculation for three minutes to clean the cabin of airborne allergens, operating with 37 per cent efficiency.

Finally, a smoke sensor is fitted at the back of the cabin, allowing the system to automatically purify the cabin air when a rear seat passenger is smoking. Cabin air is fed through a filter composed of an electret (a dielectric material that has a quasi-permanent electric charge) layer and an active charcoal layer. Dust from the cabin can be collected effectively in the electret's macromolecular fabric.

INTUITIVE HUMAN-MACHINE INTERFACE (HMI)

The advanced technology featured in the LS 460 is easy to control thanks to the vehicle's intuitive, user-friendly human-machine interface (HMI). The system is one of few on the market to combine the advantages of both touch-screen and voice command to control several functions of the navigation, audio, air conditioning and Bluetooth hands-free telephone systems. The driver can also use switches mounted on the steering wheel to operate a wide range of functions, including audio, Brake Hold and Lane-Keeping Assist systems.

The Electro Multi Vision (EMV) screen is an eight-inch, full colour, centre console LCD with a high quality VGA resolution (800 x 480 pixels) and 32,000 colours – the finest of its kind currently available anywhere in the automotive industry. Its touch-screen facility makes it very easy to operate, allowing the user to reach any function or command in a maximum of three steps. It is supported by 28 buttons on the centre console, which is at least 39 per cent fewer than for other HMIs in the segment.

The LS 460 also provides a voice command system, designed to minimise driver distraction. Using a single switch on the steering wheel gives the driver access to a wide range of vehicle functions.

SMART ENTRY SYSTEM

All LS 460 models are equipped with a Smart Entry system and are optionally available (standard on SE-L) with an electronic Card Key. With a surface measuring 83 by 43mm, the Card Key is five per cent smaller than a standard credit card, and being just 3.3mm thick, it can comfortably be kept in a pocket or wallet while driving. In spite of its small dimensions,

the Card Key is also fitted with a concealed, conventional metal key, which can provide access to the vehicle in the event of a system failure.

When the Card Key comes within 0.7 to one metre of the car's locked door, it communicates with a transmitter built into the door handle and matches identity codes, whereupon a touch of the handle will lock or unlock the door.

The Card Key can be programmed to store each driver's preferred settings, such as seat and steering wheel position. LS 460 and SE models are equipped as standard with a conventional smart key, similar to that provided on the Lexus IS and GS.

AUTOMATIC DOOR CLOSING

The front and rear doors feature an automatic closing system, which means there is no need to slam them shut. The system senses a closing but unlatched door in three tenths of a second and engages built-in electric motors to pull it fully shut.

The equipment is more compact than on previous models, adopting a planetary gear set for the actuator's reduction gear mechanism. A new electric motor works at a lower speed, reducing noise.

An optional power boot closer (standard on SE and SE-L), can completely open or close the boot lid at the press of buttons located on the smart key and inside the vehicle. This feature, first introduced in Europe on the Lexus RX in 2003, has been improved to give a completely linear closing movement, which slows in the last 15mm for more refined operation.

HIGH QUALITY SEATS

Leather upholstery is fitted as standard on the LS 460, with the highest quality European semi-aniline leather used on the SE and SE-L models. The semi-aniline leather is selected and matched to give a consistent finish throughout the interior. Extensive buffing gives the smoothest surface possible and super seam, double stitched sewing is used for the finishing. A choice of four colours is available for both types of leather to complement the interior trim: Ivory, White, Grey and Black.

To provide both comfort and improved support, the new front seat base has a three-dimensional net, tailored to the characteristics of human muscles. This improves the fit of the seat surface to help maintain passenger posture, and also has a high vibration absorbing quality that can help reduce fatigue.

Both front seats have electric multi-adjustment, including a flexing function for the centre of the seatback and four-way lumbar support adjustment (two-way for passenger). A memory function operates for both seats, with three pre-sets, governing also the position of the steering wheel and door mirrors.

The front seats are also fitted as standard with an air conditioning system, a feature that is also provided on the rear seats as part of the rear seat upgrade package (standard on SE and SE-L). It uses a semi-conductor heat exchange element to generate cold or warm air as required, and blowers in the seat back and cushion to direct air through the upholstery. Its performance is monitored by additional temperature sensors.

PREMIUM SOUND SYSTEM

A choice of two sound systems is offered in the new Lexus LS range: a standard premium system fitted to the LS 460 and Mark Levinson Reference Surround System that is featured in the SE and SE-L versions.

The premium system has a nine-channel, 290W DSP amplifier and 10 speakers for a class-leading standard audio specification. It has a single-slot six-disc, in dash CD changer that not only plays conventional CDs, but also MP3 and WMA files recorded in CD format.

There are 10 speakers, including front and rear door-mounted tweeters, upper rear door mid-range units, a large 250mm subwoofer and a new 87mm front centre speaker for improved definition and mid-range clarity. The careful positioning of the speakers ensures excellent sound reproduction throughout the cabin.

MARK LEVINSON REFERENCE SURROUND SYSTEM

The Mark Levinson Reference Surround offers the finest in-car audio experience available today. The system has been fine tuned for the specific acoustics of the LS's cabin, using more than 2,000 hours of laboratory and on-road research.

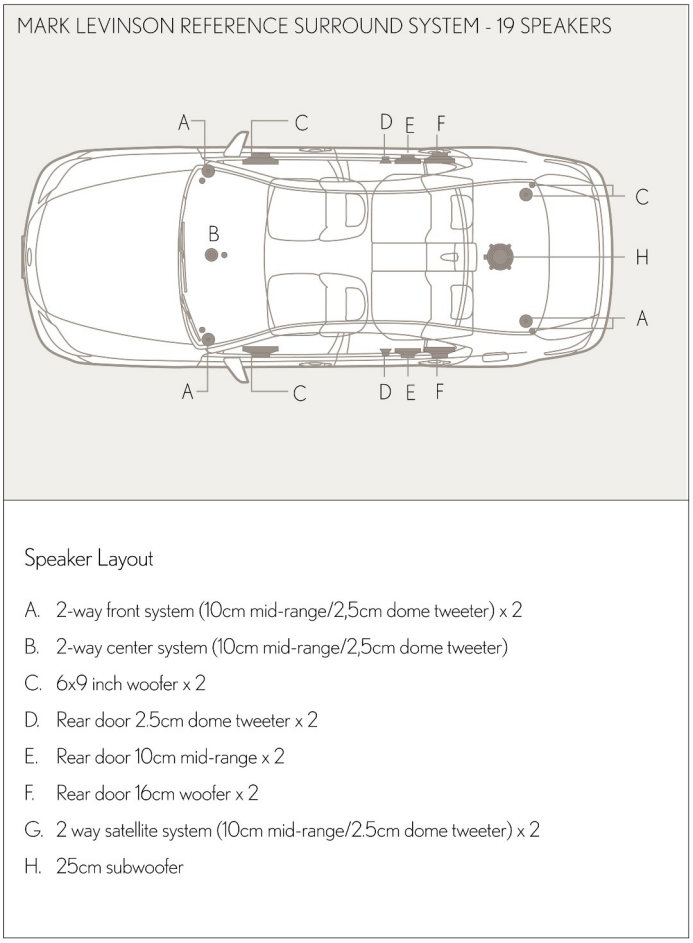
In conjunction with the Electro Multi Vision and rear display screens, the system delivers a complete, discrete 5.1 home theatre entertainment experience, for playing music, music videos and DVD movies.

15-channel 450W DSP amplifier

The all-new ML3-16 Processor Power Amplifier covers a frequency range of 20Hz – 20kHz, producing up to 450W with less than 0.1 per cent Total Harmonic Distortion (THD). The circuitry is discrete, using individual transistors, capacitors and resistors to provide a level of electronic and sonic performance that is not available from the integrated circuits typically used in standard car audio systems.

7.1 channel surround speaker architecture

Separate, fill-range side and surround channels give an extraordinary sense of musical envelopment and depth for all passengers. Notably, those in the rear do not merely experience the sound coming from behind them, as is the case with other automotive 5.1 systems.



The system's key feature is its array of 19 loudspeakers (12 of which are unique to it), each one custom engineered for the particular acoustic characteristics and location within the LS 460's cabin. There are seven 25mm tweeters, seven 100mm mid-range units, two 150mm by 230mm woofers, two 165mm woofers and one 250mm subwoofer.

Mark Levinson speakers use a variety of advanced materials, construction techniques and geometry to achieve superb results with superior power handling and durability under even the most adverse conditions.

High power/low distortion bass reproduction

Bridged channels are used to provide 100W of power to each front door woofer and rear deck subwoofer. This significantly reduces distortion and coloration, while increasing the system's dynamic capability for reproducing the high energy transient events that are a common part of today's music and movies.

All-digital signal path

Using an all-digital sonic path minimises sonic disintegration from noise, magnetic interference and signal conversions, by transmitting a more robust digital signal from the disc to the power amplifiers, so maintaining the fidelity of the original source material. Signal transmission from source to amplifier is via a fibre-optic cable.

Extensive format compatibility

The Mark Levinson Surround System is fully media-compatible with CD, CD-R, DTS 5.1, DVD video and DVD audio discs (via the EMV and rear screens), as well as MP3 and WMA music files recorded on CD or DVD. Format compatibility includes two-channel stereo (analogue and PCM), two-channel Surround Sound, Dolby Digital 5.1 (from DTS 5.1 CD, DCD video and DVD audio discs).

SPECIAL TREATMENT FOR REAR SEAT PASSENGERS

The Rear Seat Upgrade Pack, optional on LS 460 and fitted as standard on SE and SE-L models, provides passengers with a number of features which increase comfort and enjoyment.

It uses a 40:20:40 split power rear seat, with a centre flexing seatback function that allows separate adjustment of the upper seatback. This helps keep the upper body comfortably relaxed, while significantly improving forward visibility. The seats can also be adjusted for headrest height and fore-and-aft position, in conjunction with the angle of the seatback, which can be reclined by up to 38 degrees.

The rear seats are equipped with an air conditioning system that is more efficient than the standard ventilation system in maintaining the desired seat temperature.

Electrically-operated, full-size sunshades are fitted to all rear windows, including the side quarter-light. A five-litre coolbox, located between the rear seats, is perfect for keeping drinks chilled.

Rear seat passengers can also enjoy a home theatre experience via a retractable, ceiling-mounted nine-inch full colour LCD screen, which (unlike the front EMV screen) will continue to screen DVDs when the vehicle is in motion. A video plug is provided in the centre console storage compartment to enable external video equipment such as a camera or games console to be connected.

LEXUS PARKING ASSIST MONITOR

The Lexus Parking Assist Monitor is fitted to all versions of the LS, the first time equipment of this kind has been offered as standard in the segment. A video camera mounted in the rear number plate surround projects a full colour view of the surroundings behind the car on to the EMV display screen on the centre console.

As a further aid to safe and accurate reversing, screen-generated guidelines show the prospective path of the vehicle, based on the current steering position, for both series and parallel parking.

EXTENSIVE ANTI-THEFT MEASURES

Maintaining the standards set by the Lexus LS 430, which frequently topped anti-theft performance ratings, the LS 460 is designed to be one of the most theft-proof vehicles in its segment.

A new anti-theft body tilt sensor is connected to the alarm system. Using two G-sensors located in the centre console, it can detect tilt angle in all directions and will activate if the body tilts through more than 1.7 degrees from a reference angle automatically established when the car is locked.

Laminated side windows are fitted as standard and the door closer system has an all-encompassing protective structure, measures which give excellent protection against forced cabin entry.

POWER CONTROL ECU

To optimise control of the unprecedented number of high-tech electronic systems in the LS 460, the vehicle is fitted with a new Power Control Electronic Control Unit (ECU). With an

increase in the number of by-wire systems, systems that continue to function when the vehicle is parked, and systems with short-term large power demands, the new ECU continuously monitors changes in battery current, voltage and temperature, automatically instigating various measures to ensure the durability and reliability of the power supply.

For example, if the vehicle is parked for a long period, the Power Control ECU will detect and isolate abnormal current draw and progressively shift down the power supply to non-essential systems in order to maximise the battery's lifespan. The ECU regulates an adequate power supply to guarantee essential safety features, such as the Pre-Crash Safety system and Variable Gear Ratio Steering, operate to optimum levels whenever they are needed.

At all times the ECU will cut and reduce low priority loads when either battery voltage or generating capacity drops; suppress voltage fluctuations caused by short-term use of large power systems; and increase engine idling speed when insufficient battery charging power is detected. The Power Control ECU will also warn the driver should there be a charging system failure.

MANUFACTURING

Lexus continues to set the world benchmark for overall quality in the premium car market, its achievement founded on the strengths of the Toyota Production System (TPS) and Lexus's own unmatched build quality standards. In line with the company's famous "pursuit of perfection", a totally new production process, Advanced Craftsmanship, was initiated for the LS 460 at the Tahara factory.

Lexus recognises that there are still many areas of manufacturing where human skills exceed those of even the most sophisticated automated system. These skills are used in the Advanced Craftsmanship process to focus on subliminal quality: those aspects of a car that cannot be physically measured or quantified, but which are fundamental to the perception of the highest overall quality.

Advanced Craftsmanship integrates state-of-the-art automated manufacturing operations and the ultimate in digital measurement technology with the expertise and craftsmanship of highly-skilled and trained technicians at every stage of development, production and quality control. This yields significant improvements not only in overall, machine-measurable quality, but also in the perceived quality of every component, such as the tactile quality of surfaces,

the visual quality of component fit and finishes and even the sound quality of the engine note.

POWERTRAIN

From the low-tolerance manufacture of several components in the new Lexus V8 powerplant to the individual adjustment of the engine note by master craftsmen, the highest levels of engine assembly precision were required in order to meet the exacting design requirements.

Each component is meticulously cleaned and inspected before assembly; sensitive electronic items are stored separately in a dust-free atmosphere; and even the assembly line itself is sound-proofed.

Crank Shaft Polishing

The precision of the engine assembly is determined by the precision of each individual part. But even if parts are machined with high precision, minute tolerances will accumulate in the final assembly, resulting in an overall tolerance that is higher than the design value. So, in addition to increasing individual part precision, an on-line inspection process was introduced at every sub-assembly stage to verify the tolerance against the design figures.

The master craftsmen's skills are integral to every stage of the manufacturing process, particularly in the mirror-finish polishing of friction points inside the engine, such as the crankshafts.

A complete inspection of the engine can only be made when it is running, so the LS's V8 is fired up and evaluated under load to check for vibrations. After the full assembly is completed, an accelerometer is mounted to the front and rear of the crankshaft to assess the rotational balance at either end and enable adjustments to be made where necessary.

To assess the driveline quietness, the eight-speed automatic transmission is mounted on a powertrain analysis bench. A light load is applied to the differential by a motor to check for any unwanted noise or vibration. Unprecedented scrutiny is applied to the rotational balance of the overall driveline, the deflection of the propeller shaft at high speeds, and the radiation of sound from the transmission casing, such as any gear-to-gear whine from the differential that could enter the body of the car via the propeller shaft.

Finally, because even the slightest difference in vibration will cause a variation in engine sound, a craftsman undertakes a detailed vibration check of every engine, using a stethoscope to listen for any abnormal sounds from the running unit and making any adjustments needed to ensure the V8 not only conforms to its exact design specification, but also produces just the right tonal quality.

BODY AND CHASSIS

The LS's bodyshell is constructed to the highest manufacturing tolerances on a bespoke assembly line. High-precision laser welding is used in twice as many areas as on the previous LS 430, contributing to greater manufacturing accuracy and torsional rigidity.

A combination of spot and laser welding on the door corner areas at the junction of the roof and the A, B and C pillars maximises the torsional strength of the cabin and also simplifies the construction of these junctions.

An in-line inspection and measurement system is used at every stage of the manufacturing process, from component assembly to suspension, steering and powertrain sub-assembly, to ensure individual components and completed assemblies correspond to the fine detail of the Lexus engineers' design data.

The in-line measurements are cross-checked against the design parameters and stored on a database, enabling traceability and the opportunity for honing of assembly operations to deliver even greater precision.

VISUAL BODY QUALITY

The complex concave and convex surfacing of the new LS 460's bodywork renders the usual means of checking under a fluorescent light inadequate. The accuracy of the visible panel highlighting in the computer-generated images produced at the car's design stage enabled a light tunnel to be constructed in which the light tubes are perfectly positioned to allow the actual vehicle body to be precisely cross-checked against the virtual one.

The side window surrounds are fundamental to the elegant profile of the LS 460 and are finished in a seamless, integrated zinc die-cast moulding with a varying section width throughout its length. Fabricating this design element required the production equipment to be totally remodelled and an old technique for injection moulding molten zinc to be restored. Again, it takes the skills of master craftsmen to undertake hand-buffing of areas robots cannot reach and to achieve a precise fit.

PAINT QUALITY

The Advanced Craftsmanship production line combines the latest generation robotised paint coating technology with two hand polishing techniques. The car's vertical surfaces are water polished with a plane sander after each foundation coat and are checked both by eye and digitally to ensure the best perceived quality. The complete foundation coat is then water polished by hand before the top, clear coating process to give an unparalleled finish quality.

Following analysis of changes in paint colour and hue through different application techniques and variations in temperature and humidity when the paint is applied, Lexus created a bespoke, computer controlled environment for the LS 460's paint process. Temperature, humidity and paint jet volume are constantly monitored to control every aspect of the process.

Perception of a vehicle's colour can be significantly altered by factors such as the variation in light intensity at different times of day and a marked change in background colour, so Lexus continually cross-checks colour, brightness and saturation with digitised colour data on the paint check line. The LS 460 design team focused on the orientation of high-intensity

reflective materials inside the paint, such as mica, to ensure an even, metallic gloss under all light conditions.

Digital data on colour history is used to check and control the colour of every part. To eliminate differences in tone, the same foundation finish is applied to parts made of different materials, such as the bumper, and only parts which precisely match the specified digital colour data are assembled.

Due to the high brilliance of the LS 460's finished surface, a new design was necessary for the paint application technology in order to guarantee a uniform surface colour. Detailed data on spray time and volume, paint application direction and nozzle control techniques were gathered, enabling a new control programme to be created for the paint application robots. This ensures uniform painting of all panel edges, the eradication of any paint puddles, spits and colour irregularities.

Paint Finishing

As well as fluorescent tubes, the light tunnel is equipped with a light source which can combine red, green and blue primary colours to create an accurate reproduction of all natural light conditions, from dawn to dusk. This source has proved highly effective in helping the master craftsmen check the LS 460 for correct colour shading and the smallest irregularities in the paintwork.

WORLD FIRSTS

Eight-speed automatic transmission

The completely new eight-speed automatic transmission incorporates cutting-edge electronics that manage optimum gear selection, improving the new 4.6-litre V8 engine's capacity to combine competitive performance with excellent fuel economy.

Advanced Pre-Crash Safety system (PCS)

A development of the system already featured on the Lexus IS and GS models, the Advanced Pre-Crash Safety system gives extra assistance to the driver to help avoid a collision in both day and night-time driving. It incorporates an Advanced Obstacle Detection System, Driver Monitoring System, Emergency Steering Assist and Rear Pre-Crash Safety to warn the driver of an impending collision, ensure the best vehicle response to avoidance manoeuvres and, if necessary, automatically engages the brakes to reduce vehicle speed just before impact.

Advanced Obstacle Detection System

The PCS Advanced Obstacle Detection System combines information received from a millimetre wave radar and a near-infrared stereo camera. The camera has two near-infrared lenses mounted 350mm apart on the top edge of the windscreen, transmitting digital video images generated at a range of up to 25 metres by near-infrared projectors built in the high-beam units in the headlamps. Subject to weather conditions, the system can detect a wide range of obstacles by day or night, including – for the first time – pedestrians.

Driver Monitoring System

The Driver Monitoring System uses a near-infrared imaging camera mounted on top of the steering column, which gives consistent performance by day and night. The system constantly monitors side to side movement of the driver's head. If an obstacle is detected ahead while the driver's head is turned away, the system automatically activates the Pre-Crash warning function. If the situation persists, it will briefly apply the brakes to alert the driver. If these actions still fail to prompt action from the driver, all the other subsequent PCS functions will be engaged.

Emergency Steering Assist

This is one of the new features contained within the Advanced Pre-Crash Safety system. Through close interaction between the Electric Power Steering (EPS), Variable Gear Ratio Steering (VGRS), Vehicle Dynamics Integrated Management (VDIM) and Adaptive Variable Suspension (AVS), when the risk of a collision is detected, Emergency Steering Assist substantially improves the vehicle's response to driver input, improving the chances of avoiding an obstacle.

Intelligent Powertrain Control system

The Intelligent Powertrain Control system is an electronic management system which analyses, prioritises and combines the demands of the transmission, engine, VDIM and PCS system ECUs, centralising control of the throttle valve and ignition timing via the engine ECU.

The system not only optimises the speed and smoothness of any gear changes, but also effects a faster and more precise response to other ECU demands, such as those of the VDIM or Pre-Crash Safety systems.

Rear Pre-Crash Safety system

The Rear Pre-Crash Safety system uses a millimetre-wave radar, which constantly scans the area around the back of the vehicle. If it detects that a collision is inevitable, the front seat Pre-Crash Intelligent Headrests automatically move forwards and upwards to cushion the occupant's head, greatly reducing the risk of whiplash injury. The system operates whether the LS 460 is moving or stationary.

VVT-iE (Electric Camshaft Activation)

VVT-iE (Variable Valve Timing – intelligent by Electric motor) is an integral part of the LS 460's Dual VVT-i, a new, electrically controlled, continuously variable valve timing system to the intake camshafts.

Unlike hydraulically controlled systems, the electric motor-driven VVT will operate across the full spectrum of engine revolution and temperature, with a cam response speed of about 50 degrees per second towards the retard phase and 150 degrees per second towards the advanced phase.

SEGMENT FIRSTS

D-4S

D-4S (Direct injection 4-stroke petrol Superior version) is the latest evolution of Lexus's stoichiometric four-stroke direct injection technology. It features two injectors per cylinder, one installed in the combustion chamber and a second in the intake port. It combines the strengths of both direct and port injection, realising optimum engine efficiency throughout the power band and improving torque by 7.5 per cent across the rev range, while reducing fuel consumption and emissions.

Front passenger twin-chamber airbag

The front passenger twin-chamber airbag has an advanced shape that is based on the Lexus Omni Support concept. When inflated, the twin chambers create a depression in the centre of the airbag that cradles the face, while allowing the physical impact of the bag to be dispersed across other contact points on the head, shoulders and upper body.

Intelligent Parking Assist

Lexus Intelligent Parking Assist can help the driver reverse into parallel or series parking places. The system uses a rear camera and ultrasonic sensors to identify a viable space and then calculate the appropriate steering angle for the car to manoeuvre into it. Following confirmation from the driver, the system controls the steering to guide the LS into the target parking position. The driver doesn't need to make any steering input, but has to control the throttle and brake throughout the process.

Lane-Keeping Assist (LKA)

Through the Advanced Obstacle Detection System, LKA monitors white line markings on the road to determine whether a vehicle is drifting out of its given lane. It offers two functions, depending on whether or not Advanced Cruise Control (ACC) is operating.

When ACC is inactive, LKA offers a Lane Departure Warning (LDW) function that detects when the vehicle is about to leave its lane and encourages the driver to steer back on to the right course by triggering an audiovisual warning system and giving brief, pronounced steering assistance. LDW will work within lanes between three and four metres wide and at speeds from 31mph.

When ACC is operating, LKA further provides a Lane Keep (LK) function. Like LDW, LK uses an audio-visual warning display on the instrument panel and also provides steering torque to help the driver re-centre the car in its lane. This works at speeds between 47 and 106mph (75 to 170km/h) and within the same lane widths as LDW, above.

Neutral Control System

A new neutral control system, with an expanded operational range, automatically decouples engagement of the eight-speed automatic transmission in 'D' mode when the vehicle is idling at a halt, so reducing engine load and improving fuel efficiency.

Vehicle Dynamics Integrated Management (VDIM)

VDIM integrates the Electronically Controlled Brake (ECB), four-wheel independent braking, ABS, Electronic Brakeforce Distribution (EBD), Traction Control (TRC), and Vehicle Stability Control (VSC) safety systems with the Adaptive Variable Suspension, Electronic Power Steering (EPS), Variable Gear Ratio Steering (VGRS) and the Intelligent Powertrain Control System to enhance performance, optimise activation of braking, stability and traction control systems and improve the overall kinetic performance of the vehicle.

Variable Gear Ratio Steering (VGRS)

VGRS employs an actuator attached directly to the EPS gear, which alters the steering gear ratio according to vehicle speed. The system can vary the ratio by up to 31 per cent, from 2.5 to 3.6 turns lock-to-lock. VGRS promotes excellent feedback to the driver, with easier steering wheel operation at low speeds, sharper response when cornering and minimal input required when changing lanes.

UNIQUE IN SEGMENT

Electronically Controlled Braking system (ECB)

A revised electro-hydraulic ECB system incorporating a new ECU with a significantly faster processing speed than the unit installed in the Lexus GS 430, provides independent hydraulic braking power to each wheel. It delivers the best possible distribution of brakeforce and better co-operation between the various vehicle dynamic control systems.

Smart Card

The Smart Card system uses the world's thinnest electronic card key. Just 3.3mm thick, it can be kept in a pocket or wallet while driving and allows doors and boot to be opened at the touch of a handle and the engine to be switched on simply by pushing the starter button. The vehicle cannot be locked if the Smart Card is detected inside the boot or cabin and, should the battery run low, a warning message is automatically flashed up on the colour multi-information display.

OTHER ADVANCED FEATURES

Electric Power Steering (EPS)

The Electric Power Steering is designed specifically for the LS 460's front multilink suspension configuration and tyres. It uses a new step-up DC-DC power converter that increases output from 27 to 46 volts and a bespoke, high-output brushless motor.

It gives a maximum steering ratio of 16.7:1 and a class-leading turning circle of 5.4 metres. It operates noise-free with seamless, linear feedback smoothly changing its assistance characteristics according to vehicle speed.

Adaptive Variable Suspension (AVS) with vehicle posture control

The Adaptive Variable Suspension (AVS) system incorporates vehicle posture control logic to minimise the phase difference between body roll and pitch angles during cornering. This phase synchronisation elicits a smooth, controlled roll, with a well-matched vehicle response to steering, yaw and roll, and enhanced perception of rear tyre grip.

Brake Hold

The Brake Hold function is governed by the Electronically Controlled Brake ECU and works in conjunction with the electro-mechanical parking brake. When the Brake Hold standby switch is activated, Brake Hold is engaged whenever the vehicle stops removing the need for the driver to maintain pressure on the brake pedal. To start the car moving again, the driver needs only to press the accelerator.

Dual VVT-i

Incorporating VVT-iE, Dual VVT-i is a low pressure loss, variable intake and exhaust timing system that can provide a greater intake/exhaust valve overlap when necessary. This gives greater engine flexibility, reflected in benefits such as higher performance with better fuel efficiency and emissions levels.

LEXUS LS 460 TECHNICAL SPECIFICATION

ENGINE	
Engine type	90˚ V8
Valve mechanism	4 valves per cylinder, chain driven, Dual VVT-i, VVT-iE for intake
Displacement (cc)	4,608
Bore x stroke (mm)	94.0 x 83.0
Compression ratio	11.8:1
Fuel type	Petrol, 91 octane or higher
Injection system	D-4S (Direct injection 4-stroke petrol Superior version)
Max. power (bhp/DIN hp @ rpm))	375/380 @ 6,400
Max. torque (Nm @ rpm)	493 @ 4,100
PERFORMANCE	
0-62mph (sec)	5.7
50-75mph (sec)	4.7
Max. speed (mph)	155

FUEL ECONOMY/EMISSIONS		
Urban (mpg)		17.1
Extra-urban (mpg)		35.8
Combined (mpg)		25.4
CO_2 emissions (g/km)		261
VED band		G
DIMENSIONS		
Overall length (mm)		5,030
Overall width (mm)		1,875
Overall height (mm)		1,465
Wheelbase (mm)		2,970
Track – front (mm)		1,610 (18in tyre)/1,615 (19in tyre)
Track – rear (mm)		1,615 (18in tyre)/1,620 (19in tyre)
Overhang – front (mm)		885
Overhang – rear (mm)		1,175
Interior length (mm)		2,150
Interior width (mm)		1,600
Interior height (mm)		1,185 (1,165 with sunroof)
Coefficient of drag (Cd)		0.26
Fuel tank capacity (l)		84
Luggage compartment capacity (l)		505 (385 with rear air conditioning unit)
WEIGHTS		
Kerb weight (kg)		1,945 – 2,055
Gross vehicle weight (kg)		2,495
Towing capacity – braked (kg)		2,000
Towing capacity – unbraked (kg)		750
TRANSMISSION		
Code		
Type		Eight-speed automatic. longitudinal, rear-wheel drive
Gear ratios	1st	4.596
	2nd	2.724
	3rd	1.864
	4th	1.464
	5th	1.231
	6th	1.000
	7th	0.824
	8th	0.685
	Reverse	2.176
Final drive ratio		2.937
SUSPENSION		
Front		Multilink
Rear		Multilink
Shock absorbers/springs		Adaptive Variable Suspension with Vehicle Posture Control; air suspension with automatic height control
BRAKES		
Front (dimensions mm)		Four-piston callipers, ventilated discs Ø357 x 34
Rear (dimensions mm)		Two-piston callipers, ventilated discs Ø335 x 22

Additional features	Electronically Controlled Brake (ECB) system; Vehicle Dynamics Integrated Management (VDIM); Hill-start Assist control (HAC); emergency stop signal; brake hold; electric parking brake
STEERING	
Steering gear type	Rack and pinion, Electric Power Steering (EPS)
Ratio	11.6 – 16.6 (11.7 – 16.7 19in tyre)
Turns lock-to-lock	2.5 – 3.6
Minimum turning radius – tyre (m)	5.4
Additional features	Variable Gear Ratio Steering (VGRS)
WHEELS AND TYRES	
Wheels	R18 7.5J (option R19 8.0J)
Tyres	235/50 (option 245/45)

LEXUS LS 460 EQUIPMENT SPECIFICATION

SAFETY & DRIVING DYNAMICS		LS 460	LS 460 SE	LS 460 SE-L
ABS		✓	✓	✓
Brake Assist System (BAS)		✓	✓	✓
Electronic Brakeforce Distribution (EBD)		✓	✓	✓
Emergency Brake Signal		✓	✓	✓
Electronically Controlled Braking (ECB)		✓	✓	✓
Traction control (TRC)		✓	✓	✓
Vehicle Stability Control (VSC)		✓	✓	✓
Variable Gear Ratio Steering (VGRS)		✓	✓	✓
Vehicle Dynamics Integrated Management (VDIM)		✓	✓	✓
Adaptive Cruise Control (ACC) and Pre-Crash Safety system (PCS)		Opt	Opt	×
Advanced Safety Pack	Adaptive Cruise Control and Pre-Crash Safety system	Opt	Opt	✓
	Advanced Obstacle Detection			
	Rear Pre-Crash Safety system			
	Driver monitoring system			
	Emergency Steering Assist			
	Lane Keep Assist			
	Lane Departure Warning system			
Two-stage driver and front passenger airbags		✓	✓	✓
Dual-chamber front passenger airbag with cut-off switch		✓	✓	✓
Front passenger airbag cut-off switch		✓	✓	✓
Driver and front passenger knee airbags		✓	✓	✓
Front and rear curtain shield airbags		✓	✓	✓
Rear side airbags			✓	✓
Thorax-Abdomen-Pelvis (TAP) front side		✓	✓	✓

airbags			
Whiplash Injury Lessening (WIL) front seats	✓	✓	✓
Front and outer rear seatbelt pretensioners	✓	✓	✓
ISOFIX child seat mounts, outer rear seats	✓	✓	✓
Audible seatbelt reminder	✓	✓	✓
Air suspension	✓	✓	✓
Adaptable Variable Suspension (AVS)	✓	✓	✓
Electric Power Steering (EPS), speed sensitive	✓	✓	✓
Electronic Parking Brake (EPB)	✓	✓	✓
Tyre Pressure Warning System (TPWS)	✓	✓	✓
SECURITY	**LS 460**	**LS 460 SE**	**LS 460 SE-L**
Anti-theft system with immobiliser, intrusion sensor, inclination sensor and siren	✓	✓	✓
Double door locks	✓	✓	✓
Laminated windscreen and side window glass	✓	✓	✓
ENTERTAINMENT, INFORMATION & COMMUNICATIONS	**LS 460**	**LS 460 SE**	**LS 460 SE-L**
10-speaker premium audio system with in-dash 6-disc CD changer	✓	×	×
Mark Levinson 19-speaker premium hifi with in-dash 6-disc DVD changer	Opt	✓	✓
Rear audio controls	Opt[1]	✓	✓
Bluetooth connectivity	✓	✓	✓
8in touch-screen Electro Multi Vision (EMV) display	✓	✓	✓
Colour TFT multi-information display	✓	✓	✓
DVD satellite navigation with dynamic Route Guidance (DRG)	✓	✓	✓
Steering wheel controls for audio, phone and voice control	✓	✓	✓
Voice command function for audio, navigation and climate control operation	✓	✓	✓
Optitron instrumentation	✓	✓	✓
Parking Assist Monitor	✓	✓	✓
Intelligent Park Assist system	Opt	Opt	✓
COMFORT & CONVENIENCE	**LS 460**	**LS 460 SE**	**LS 460 SE-L**
Smart entry and start system	✓	✓	×
Card entry and start	Opt	Opt	✓
Illuminated entry system with puddle lights	✓	✓	✓
Illuminated front and rear vanity mirrors	✓	✓	✓
LED interior lighting	✓	✓	✓
Cruise control	✓	✓	✓
Electric multi-adjustable steering wheel	✓	✓	✓
Easy exit & entry auto-retracting steering wheel	✓	✓	✓
Auto-dimming rear-view mirror	✓	✓	✓
Electric windows with one-touch operation	✓	✓	✓
Electric rear sunshade	✓	✓	✓
Electric sunshades for rear doors	Opt[1]	✓	✓

Sunroof		Opt	✓	✓
Heated wooden steering wheel		Opt	Opt	Opt
VENTILATION		**LS 460**	**LS 460 SE**	**LS 460 SE-L**
Electronic dual zone climate control with separate driver/passenger controls		✓	×	×
Automatic recirculation mode		✓	✓	✓
Clean air filter with pollen removal mode		✓	✓	✓
4-zone climate control with rear left/right temperature control		Opt[1]	✓	✓
Roof-mounted diffusers		Opt[1]	✓	✓
SEATING, UPHOLSTERY & TRIM				
Leather upholstery		✓	✓	×
Upholstery upgrade pack	Semi-aniline leather upholstery and trim details	Opt	Opt	✓
	Alcantara roof lining and pillar trim			
Heated and air conditioned front seats		✓	✓	✓
Heated rear seats		✓	✓	✓
Air conditioned rear seats		Opt[1]	✓	✓
10-way electrically adjustable driver's seat and head restraint		✓	✓	✓
8-way electrically adjustable front passenger seat and head restraint		✓	✓	✓
Memory function for front seats, steering wheel and door mirrors with three pre-sets		✓	✓	✓
Front seat lumbar support		✓	✓	✓
Electrically adjustable rear head restraints		✓	×	×
Electrically adjustable rear head restraints with memory setting		Opt[1]	✓	✓
Electric rear seat slide/recline adjustment		Opt[1]	✓	✓
Electrically adjustable front seatbelt height with memory on driver's side		✓	✓	✓
Leather trimmed steering wheel and gear shift lever		✓	✓	✓
Wood trim inlays		✓	✓	✓
Rear cool box		Opt[1]	✓	✓
Rear wood console		Opt[1]	✓	✓
BODY & EXTERIOR		**LS 460**	**LS 460 SE**	**LS 460 SE-L**
9-spoke 18in alloy wheels		✓	✓	×
5-spoke 19in alloy wheels		Opt	Opt	✓
Full-size alloy spare wheel		✓	✓	✓
Auto dimming electrically adjustable heated and folding door mirrors		✓	✓	✓
Easy door and boot closer		✓	✓	✓
Power boot closer		Opt	✓	✓
High-Intensity Discharge (HID) auto-levelling bi-xenon headlights with cleaning system		✓	✓	✓
Adaptive Front-lighting System (AFS)		✓	✓	✓
Front foglights		✓	✓	✓
LED brake, tail and licence plate lights		✓	✓	✓
Rain-sensing wipers		✓	✓	✓

UV and heat-insulating tinted glass	✓	✓	✓
Water-repellent front side window glass	✓	✓	✓

Opt[1]: only available as part of Rear Seat Upgrade Pack option (rear audio controls, electric rear door sunshades, 4-zone climate control, roof-mounted diffusers, air conditioned rear seats, electrically adjustable rear head restraints with memory setting, electric rear seat slide/recline adjustment, rear cool box and rear wood console).