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The new Audi A4 press information

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Short version

The new Audi A4 The sportiest midsize saloon

Sporty and superlative, progressive and emotive – the A4 takes Audi into a new dimension in the midsize car segment. The saloon's launch engines – two TDI units and two petrol engines that also have direct fuel injection – provide supreme performance with fuel consumption that is an average of nine percent lower than the previous model. The highly efficient powertrains are just as clear evidence of Audi's outstanding technical expertise as the dynamic suspension or the many other technologies adopted directly from the large luxury class. The new Audi A4 – the new way to drive.

New design idiom

The new Audi A4 combines many fascinating aspects. Its design is expressive, taut and dynamic. The high precision and technical character of its styling clearly confirm Audi's leading position in this field. Compared with the previous model, the designers have altered the proportions to create a new, sporty impression. The front overhang is shorter, the bonnet and wheelbase distinctly longer.

At an overall length of 4.70 metres, the new A4 is a large saloon. It boasts a substantial, powerful road presence. Its body illustrates the technical progress that has been made: it is significantly more rigid and safer than the previous model, but also distinctly lighter, thanks to intelligent weight-saving. With a drag coefficient of $c_D = 0.27$, the new saloon cuts its way through the wind with ease, and its 480-litre boot is larger than that of any of its direct competitors.

Inside the new A4, the ambience is spacious and full of light, as would be expected in a much larger model. It embodies the traditional Audi strengths: a distinguished appearance, no-compromise high-quality workmanship with close attention to detail and logical, intuitive controls.

A whole series of high-tech optional extras taken from the luxury class is available to enhance the interior still further, from the MMI operating system, acknowledged as being superior to its competitors, to the automatic air conditioning with three-zone control. To take one's seat in the new A4 is to experience the sensation typical of an Audi – one immediately feels at home. In the safety area too, the brand sets new standards: the airbags and seat belt force limiters work together even more effectively to protect the occupants better than ever before.

The new Audi A4 is being launched in Australia with a choice of four refined, powerful engines, covering a power-output range from 105 kW to 195 kW. All of them use the direct fuel injection principle: FSI technology for the two petrol engines and the common-rail system for the two TDI units. The four-cylinder engines are turbocharged. With their smooth running and impressive flow of power, the engines in the new A4 are a source of pure driving pleasure. They also use distinctly less fuel than the corresponding units in the previous model: consumption is down by an average of 13 percent for the petrol engines and six percent for the TDI units.

More dynamic than ever: the quattro driveline

In the transmission area, Audi offers customers a wide range of high-tech solutions. Easily operated manual gearboxes or tiptronic automatic transmissions, and also the multitronic continuously variable transmission, deliver engine torque to either the front wheels or the quattro permanent four-wheel-drive system. For the new saloon model, this is more dynamic than ever before, with the torque split biased more strongly to the rear wheels.

The driver will experience the new A4 as the sportiest of the midsize saloons – a car that is agile, precise and effortless to control. The differential has been moved further forward in the driveline by interchanging its position with the clutch or torque converter. This has enabled the front axle to be repositioned 154 mm further forward – a solution that permits the axle loads to be ideally balanced. For the new Audi A4, the dynamic suspension is a totally new development. Thanks to the use of numerous aluminium components, the suspension, steering, wheels and brakes are exceptionally light in weight.

Two innovative technologies add even greater fascination to the driving experience. One of them is the Audi drive select control system, with which the driver can adjust the operating characteristics of the engine, automatic transmission, steering and adaptive damping to suit his or her own preferences. The other is Audi dynamic steering, which operates with a superimposed gear system that varies the effective steering ratio according to road speed. Close to the handling limits, it acts together with the ESP to stabilise the car by slight but very rapid adjustments to the steering. In this way, the system combines sporty driving fun with a high level of safety.

The innovative assistance systems on the new A4 make driving even more relaxed and enhance the driver's control of the situation. Audi equips its new saloon model on request with various high-tech systems that have so far been available only on luxury cars.

These systems control the distance from the car in front, help the driver to keep within the chosen lane or to move safely from one lane to the next, and provide support when parking the car.

Technical area of the future: multimedia

The Audi A4 also sets new standards for a midsize car in one of the most fascinating technical areas of the future, namely multimedia. The new saloon enters production with a series of communication and entertainment technologies at the customer's disposal that would be impressive even in a luxury-class car.

Among the components are various audio systems, a TV receiver, two navigation systems, an iPod interface and a highly convenient Bluetooth telephone.

At a glance - The new Audi A4

Body

- Length 4703 mm, width 1826 mm, height 1426 mm, $c_D = 0.27$
- Now longer by 117 mm, 55mm wider, more spacious
- Wheelbase + 167 mm, front track + 45 mm, rear track + 36 mm
- Luggage capacity 480 litres, larger than any core competitors
- Taut, sporty styling, low weight
- Outstanding safety concept with new airbag and seat belt force limiter settings

Interior

- Ample space at all seats including more rear leg space and shoulder width for passengers
- Exemplary ergonomics, driver-orientated cockpit, MMI control terminal available (option)
- Exceptional fit and finish, leather interior and steering wheel as standard

Engines at launch

- Two strong, economical petrol engines with FSI direct injection - 1.8 TFSI and 3.2 FSI
- Two powerful, refined TDI diesels with either four (2.0 TDI) or six cylinders (2.7 TDI) and common rail fuel injection with piezo injectors
- Diesel Particulate Filter (dpf) as a standard feature
- 3.0 TDI engine to arrive in October 2008
- TDI engines are the basis for progressive performance strategy – 2.0 TDI e concept and 3.0 TDI as world's cleanest diesel engine.

Transmissions

- Six-speed manual gearbox, multitronic, or six-speed tiptronic
- For 3.2 FSI: quattro permanent four-wheel drive with 40:60 torque split

Running gear

- Audi dynamic suspension, long wheelbase and front axle moved forward for dynamic handling and outstanding road behaviour
- Option of Audi drive select dynamic driving system
- Option of variable-ratio dynamic steering for sporty driving pleasure

Equipment

- Generous specification with many features found on luxury-class cars also available on the new A4 including Audi Side Assist, Lane Assist, adaptive Cruise Control, Bang & Olufsen stereo system.

Long version

Exterior design

The sportiest car in the midsize market segment, and also a comfortable saloon model for supremely relaxed travel – the new Audi A4 has many different facets. The new, dynamic proportions are tense and emotive; the precision outlines of the body underline the leading role that Audi plays in automotive design.

4703 mm long, 1826 mm wide – these are the dimensions of an impressive large saloon model. The new Audi A4 exceeds its main competitors quite clearly in both length and width, though at 1426 mm its height is less than theirs. These proportions are the key to the visual dynamism of the sportiest saloon on the midsize car market.

Compared with the previous model, the new A4 has clearly grown in size, and has at the same time acquired new, dynamic proportions. The front body overhang is now shorter, whereas the bonnet and wheelbase are both longer. Seen on the road, the new A4 flexes its muscles – with a sense of greater substance and power than its predecessor possessed.

Personality: star billing for the A4

With the new A4, Audi once again demonstrates its leading role in the automotive design field. The designers have re-interpreted classic elements from the brand's formal vocabulary and given it balance and tension. The results are taut and concentrated – a personality that takes star billing.

It is as if the saloon body's outer skin had been modelled from the solid by a sculptor's sure hand. The front end, passenger compartment and rear end blend smoothly into one another, and a coupé-style roof line emphasises the flowing silhouette.

The sculpted surfaces provide a contrast to the clear, dynamic lines. In its precision, the design clearly pursues Audi's goal of no-compromise quality.

The front end of the new Audi A4 exudes assurance to a special degree. The bonnet is tautly and powerfully contoured, with bold V-pattern lines extending forward to the nose. In contrast to the previous model the Audi single-frame grille that dominates this aspect of the car is broader and lower. The edge of the bonnet intersects lightly with the tops of the headlights, a device that suggests determination and is strongly expressive. The curving lower

contour provides an elegant touch, supported by a subtle fold in the metal. Audi presents the headlights as complex elements – technology as an art form.

Distinguishing features: the “wings”

Depending on the version, the headlights vary in a number of details. A strong visual impression is made by the “wing” elements in electrodeposited chrome, which differ considerably according to whether halogen or xenon plus headlights are specified. With halogen headlights, the wing has a second shorter element, whereas with xenon plus it takes the form of a single continuous curve.

A standard feature common to both systems is the daytime running light – one of the many safety technologies that Audi has pioneered. In the halogen headlights, which are rated for an operating distance of well over 100,000 kilometres, it is provided by bulbs with a rating of just 13 watts. The xenon plus units, in which mercury is no longer used, each incorporate 14 white light-emitting diodes, with a total consumption of no more than nine watts.

Audi daytime running lights are a deliberately chosen design feature. They give the front end of the new Audi A4 an original, unmistakable appearance.

The third of the significant visual elements at the front of the car are the two large air inlets, three-dimensional in shape, with the standard halogen fog lights recessed into them.

Trapezoidal and broadening at the bottom, they emphasise the line of the single-frame grille and also the horizontal features of the car’s nose. A spoiler slightly recessed below the single-frame grille completes the front-end styling.

Full of strength: the side view

When seen from the side, the new Audi A4 again communicates an impression of taut, forward-striving power, an image of sporty energy enhanced by the long bonnet with its elegant transitions to the front side panels and the set-back occupant cabin. A typical Audi styling principle is that the body accounts for two-thirds of the vehicle’s overall height, with the remaining third consisting of the greenhouse.

The outlines acquire their free-flowing character from the coupé-style silhouette. To prevent the roof, which is quite markedly lowered toward the rear, from reducing rear seat occupants’ headroom, the C-post roots are positioned fairly wide apart on the broad, muscular shoulders of the body. A small spoiler neatly included in the overall outline extends the boot lid

visually. The feature line, inserted at a slight angle in the rear roof area, has the effect of lowering the greenhouse still further. The sides of the body and the roof are joined by a scarcely visible flush seam – a complex technical process that concentrates high precision in both the design and body construction areas.

An important and constantly re-interpreted tool in the Audi designers' stylistic armoury is the interplay of light and shade, of convex and concave surfaces surrounded by boldly emphasised lines. The tornado line, a hand's width below the windows, is a striking element in the side view.

This line, sketched in by a sure hand, runs along the front and rear wheel arches; its contour is particularly bold in the centre before tapering away at the ends. As it crosses the front door the tornado line falls gently, dividing the area above the rear wheel in such a way as to avoid any suggestion of unnecessary bulk.

The dynamic line above the door sills, however, pursues a different path: it rises continuously and also extends over the rear end of the car. The sill and the line formed by the lower edge of the windows, on the other hand, are effectively horizontal. This interplay of lines gives the side view a taut character. Substantial loop-pattern door handles, large wheels and accentuated wheel arches add to the effect of concentrated energy.

The tail of the car, with a spoiler lip that forms an elegant arc, also interprets the theme of the dynamic saloon in a subtle way. It is drawn in and thus makes the rear wheel arches clearly visible. The slim, horizontally arranged light units taper inwards and create a visual relationship with the road; their reflectors add depth to what the onlooker sees. A narrow strip at the lower edge for the flasher and reversing light adds a further sense of width at the rear. When the lights are on, the strip-pattern reflectors create a zone of light of limited height.

Dividing the rear light units vertically in the centre enables a wide boot lid to be provided. A recess of generous area is provided for the licence plate above the bumper, which has a boldly flared upper edge of trapezoidal shape that introduces its own sporty note. Below the bumper is a diffuser finished in dark grey.

Cars with a four-cylinder engine have twin exhaust tailpipes on the left; those with a V6 engine have two separate tailpipes, one on each side, with a ground finish. Both petrol-engined and diesel-engined cars have straight exhaust tailpipes, an indication that Audi TDI engines are not only sporty but also 'clean'.

The symbol for sport: S line from Audi (available in Australia from July 2008)

Audi offers the sporty S line body package to especially dynamic drivers, with several different exterior design details. These concern the front and rear bumpers, the front spoiler, the air grilles on the sides, the diffuser insert and the sill strips. The S Line package has an rrp of \$3,600.

S line badging is applied to the front side panels and the door sill strips. These emblems are also included in the S line Sport package, which includes the S Line exterior package, sports suspension, sports leather seats with S Line embossing, S Line sports steering wheel, matt brushed aluminium inlays and blackheadlining, 18-inch alloy wheels and the two exclusive paint finishes Misano Red and Avus Silver.

The new Audi A4 is available in 15 attractive colours – a bigger selection than any competitor offers. The three solid paint finishes are called Brilliant Red, Brilliant Black and Ibis White. The names of the twelve metallic and pearl-effect finishes are as follows: Dakar Beige, metallic; Garnet Red, metallic; Lava Grey, pearl effect; Liquid Blue, metallic; Phantom Black, pearl effect; Quartz Grey, metallic; Sphere Blue, metallic; Deep Green, pearl effect; Deep Sea Blue, pearl effect; Aruba Blue, pearl effect; Ice Silver, metallic and Meteor Grey, pearl effect.

Body

The new A4 is a large saloon car with a powerful road stance. Its body is strong in the truest sense of the word: thanks to new high-tech materials and processes, it is safer and more rigid than the previous model. It has also shed a significant amount of weight; with a drag coefficient of $c_D = 0.27$, the new Audi A4 cuts smoothly through the wind.

By midsize standards, the new Audi A4 is an exceptionally large, spacious saloon. Its wheelbase of 2808 mm is not only longer than its predecessor but also distinctly longer than its competitors, and indeed approaches that of a model in the luxury class. The space for each of the five seat occupants is correspondingly generous, and the high standard of dynamic stability and calm, unwavering straight-line stability also profit from this long wheelbase.

The governing factor has been the repositioning of the front axle further forward. This in turn was made possible by moving the differential to the front of the driveline, where the clutch or torque converter was formerly situated. This layout, which has already proved successful in the large A8 luxury saloon, has a further major advantage too: it is a sound basis for the new Audi A4's fascinating road dynamics.

Balancing act: the battery has moved to the boot

A further factor in the new Audi A4's excellent balance is the relocation of the battery to the lower level of the boot. On both front-wheel-drive and quattro cars, the boot holds 480 litres, a volume that also puts the new A4 in the lead among its direct competitors.

Thanks to a loading lip that is only 673 mm from the ground, the low step when loading, the straight side walls and flat floor, the boot can be utilised in a most practical way. It is lined with high-quality carpet and, with a loading width of 1000 mm throughout and a length of 1067 mm, can easily accommodate two golf bags placed sideways.

Among the many new A4 features that bring more than a hint of the luxury class with them is the boot lid opening system. There are three ways of gaining access to the boot: by radio-operated remote control, by pressing a button on the driver's door or by touching the electrical switch in the handle recess. Any of these causes the lid to swing up automatically on its innovative hinged arms. Closure remains manual but needs very little physical effort.

The rear seat backs have been arranged to fold down, a useful feature for those who require flexibility and who have to transport bulky loads.

The seat back catches can be released by handles from inside the car and folded down on to the seat cushions without the head restraints having to be removed. In this way, the luggage capacity is increased to 962 litres. Another optional extra is a load-through hatch complete with removable ski bag.

Intelligent weight-saving construction: basic weight only 1410 kilograms

A major strength of the new saloon model bearing the four-ring badge is its low weight, which adds to the pleasure of the sporty driver and also reduces fuel consumption. The A4 1.8 TFSI tips the scales at just 1410 kilograms; the figure for the 2.0 TDI is 1460 kg. Iron and steel account for 32.0 percent of the total weight, closely followed by aluminium and magnesium at 31.7 percent.

The low weight is also explained by the fact that the steel bodyshell is exceptionally light: although it is almost twelve cm longer and more than five cm wider than the previous model, it weighs about ten percent less. This was an ambitious target that Audi's engineers solved by a total redesign of the bodyshell, starting from scratch on a clean computer screen.

Audi had been among the automobile industry's absolute leaders for a long time in the intelligent weight-saving area. By adopting aluminium, for instance on its A8 and TT models, the company has kept the pressure on the steel industry for some years now, with the result that steel grades combining exceptional strength with low weight have now become available.

Hot-formed ultra-high-strength steels are an excellent example. They are the finest grades that the industry can currently supply. On the new A4, they are used to reinforce the centre tunnel and for sections of the side members, for the inner body sills, the firewall cross-member in the engine compartment and for the B-posts. If the same metal thicknesses are used as for conventional high-strength steels, the new grades possess much better mechanical properties. If on the other hand the previous mechanical properties are adequate, the gauge of the metal can be reduced.

In the hot forming process individual blanks made of boron-alloyed steel are heated to approximately 950 degrees Celsius in a continuous furnace, then shaped and quenched at the same time in specially cooled tools. The resulting microstructure enables high dimensional accuracy to be maintained and above all high tensile strength values to be reached.

These are in the region of 1650 Megapascals – similar to the cables of a modern suspension bridge, in which a single wire with a cross-section of 1 mm square has to carry a weight of

more than 160 kilograms. Seven Audi A4 cars together weighing ten metric tons could be hung from a strip of this material only two mm thick and 30 mm wide.

The aim: controlled deformation

This is not to say that a totally rigid bodyshell would be ideal for a production car. On the contrary, the aim is to control the dissipation of forces by means of specific levels of deformation, so that loads on the car's occupants are kept low. A large element produced from a single sheet-metal blank must therefore be of lower strength in certain predetermined part-areas.

In order to achieve this, the wall thicknesses of the warm-formed boron-alloyed steel are partially reduced, or it is combined with materials of lower strength such as micro-alloyed steels. The welded elements produced in this way are known as tailored blanks.

An excellent example of this process is the B-post for the new Audi A4. Its lower zone is rather more ductile (deformable) than the upper zone, since this is where energy has to be dissipated in the event of a side-on collision, taking into account the fact that the human pelvis can withstand more severe loads than the rib cage. The B-posts and the rear sections of the side members are in-house products; Audi is in fact the first automobile manufacturer to establish its own production facility for warm-formed tailored blanks.

Hot-formed ultra-high-strength steels already account for 12 percent by weight of the new A4's body-in-white, that is to say without doors, windows, bonnet and boot lids. 18 percent are accounted for by conventionally processed ultra-high-strength steels, 32 percent by high-strength steels and 38 percent by conventional deep-drawing steel grades.

The joining techniques used for the body panels also exert a strong influence on rigidity and crash behaviour. Audi has adopted state-of-the-art methods once again for the new A4. Compared with the previous model the number of spot welds has gone down from 6500 to about 5500; in contrast, the total length of bonded seams has gone up from 26 to 125 metres.

Structural adhesive, a ductile elastic material that is applied hot, increases the strength of the joint and guarantees that flanges are fully sealed at the many points where this is necessary. It also allows the electric spot welds to be more widely spaced. In many areas, the two joining methods are combined. At the most crucial zones of the body, integral camera systems monitor the robots as they apply the adhesive to a very high standard of precision.

Art in body construction: the zero-gap roof joint

In addition to MIG and MAG welding, Audi makes use of two other complex techniques. Laser-beam welding is used at the sills and for the doors. The seam between the body side and the rain gutter at the boot, and the zero-gap joint between side element and roof – an extremely difficult area on any car – are produced by plasmatron brazing.

Audi's high-tech character and quality approach not only become visible in these areas, but in fact everywhere on the body where narrow, strictly parallel joint gaps can be seen. Further proof of this high standard has been provided for many years now by the fully galvanised bodyshell, which enables a twelve-year warranty against body penetration by rust to be offered.

The highest possible level of occupant protection

Occupant protection reaches the highest possible standard in the new Audi A4. For this design area the brand makes use of a variety of sources and possesses a broad basis of relevant knowledge from its own investigations: all over the world, the AARU (Audi Accident Research Unit) looks into actual accident situations and evaluates data banks as appropriate.

If a frontal collision should occur, the A4 protects its occupants with an exactly planned sequence of measures, the precision of which sets new standards for a midsize car. In the very earliest stages of the crash, two acceleration sensors begin to transmit their signals to the central control unit; they are located below the headlights so that no time is lost in securing this initial information.

As the impact progresses, the front cross-member distributes the forces to both side members, which thanks to their carefully computed geometry and choice of materials deform to a predetermined degree to absorb this energy. The aluminium frame element for the engine and front axle acts as a further force absorption level by diverting forces and moments in a controlled manner into the floor and tunnel structure of the occupant cell. The steering column can be forced back by a maximum of eight cm, and the main elements of the pedal assembly released from their mountings.

Accurately matched: the occupant restraint systems

The task of protecting people of different sizes and statures in a head-on crash is a difficult one. Laboratory research carried out in Germany, the USA and Canada using dummies has shown that small people are still at considerably greater risk than tall occupants. In the new

A4, Audi has therefore networked the occupant restraint systems more closely together than on any midsize car so far produced.

Sensors on the seat rails check the seated position adopted by the occupant and transmit these data to the control unit as information for the computing process. In this way the computer knows how far the seat occupant is from the airbag and can ensure that the amount of forward movement, during which the seat belt and the airbag can restrain the body, is optimally utilised.

The airbags in the new Audi A4 are adaptive and make use of an innovative, finely differentiated strategy capable of protecting the car's occupants even more effectively and reducing the loads on their bodies. The conventional technique is for the two airbag stages to be triggered off one after the other; if the impact is not too severe, the first stage alone is sufficient, whereas in a more violent collision the second stage follows directly after the first. In other words, the only computing criterion is the severity of the impact.

In contrast, the airbags in the Audi A4 are always inflated fully. If the control unit assesses the situation as relatively harmless, that is to say if the impact is not too violent and the seat occupant is sitting close to the cockpit, part of the gas from the airbag is discharged again through valves, so that the head and chest of the occupant are restrained without undue force. If the crash is severe, the airbags remain fully inflated for longer. The true innovation, however, is that the same procedure is adopted after a less severe impact if the passenger is sitting so far back that his or her upper body moves forward with too much kinetic force.

For safety: adaptive seat-belt force limiters

The seat-belt force limiters also use an adaptive operating principle, with two integral torsion bars connected together by gearwheels. In a not too critical situation, the torsion bars are separated at an earlier stage in the accident. This gives the belt a greater range of movement – the seat occupant's upper body plunges relatively deeply into the airbag and the load that has to be withstood in the chest area is reduced. In a severe accident, on the other hand, the torsion bars are either disconnected later or remain coupled together, so that the seat belt restrains its wearer more firmly.

In the event of a side-on impact, acceleration sensors in the C-posts and ultra-modern pressure-change detecting sensors in the doors trigger off the alarm. The B-posts, which guide part of the incoming forces into the roof frame, the sills and two cross-members in the floor between these, perform most of the deformation work, aided by the doors. The edges of the

doors overlap the posts, sills and roof frame to a generous extent and can therefore bear against these elements and help to maintain the strength of the overall structure.

A positive feature is that the new A4's doors are made in a single piece, unlike those on the previous model, which had a separate aluminium window frame. These frames and the impact-absorbing support members made of high-strength steel are now integrated into the body-in-white structure, so that the doors are lighter in weight but also more rigid. The close proximity of the support member to the door hinge enables forces to be deflected into the B-post.

All-round protection: up to eight airbags

Inside the car, sidebags with a volume of 13 litres are integrated into the front seats (12-litre sidebags are an option for the rear seats), and large windowbags (25.5 litres) cover the glass between the A- and C-posts. Furthermore, the driver and front passenger in the new Audi A4 are effectively protected against accidents of kinds by variable-height seat belts, head restraints with a generous amount of vertical adjustment and anti-submarining ramps in the seats – a solution that not all competitors offer as standard.

If the car reaches 25 km/h but the seat belts have not yet been fastened, a warning gong is heard. A seat occupation sensor identifies whether the front passenger seat is in use. Child restraint points are standard.

Rear-end collisions also lose much of their injury potential in the new A4. The multi-section side members and the rear-axle support frame deform as a means of absorbing kinetic energy; the rear wheels make contact with the body sills if necessary. The package consisting of the car's jack, battery, temporary spare wheel and hi-fi components does not form a single block. If its components are displaced by a severe impact, they remain clear of the tank filler pipe, and the fuel flow to the engine is interrupted; safety valves prevent the fuel tank from emptying if the car should overturn.

The fuel tank, with a capacity of 65 litres on versions of the car with front-wheel drive and 64 litres on those with the quattro driveline, is constructed from six layers of plastic and can withstand very severe loads. After an accident, the control unit releases all the door locks, and at the same time the high-current line between the battery, starter motor and alternator is disconnected. However, the electrical energy supply to important components such as the occupant restraint systems, the hazard warning flashers and the door electrics remains active.

With Audi backguard, the seats and head restraints in the new Audi A4 are designed to provide reliable protection against injuries to the upper bodies of the front passengers in the event of a rear-end impact. This special 'Whiplash' system has obtained "good" ratings in independent tests. If the rear-end collision is severe, the seat-belt tensioners are triggered off in order to hold the occupants in a favourable position in their seats.

Pedestrian protection: new solutions

The new A4 is one of the very first cars to comply with all the new Japanese and European regulations concerning collisions with pedestrians. Foam material ahead of the bumper cross-member, ample deformation space and sheet-metal zone designed to deform effectively are among the specific features, together with special front-wing mountings designed to yield on impact.

The most frequent accidents, fortunately, are the more harmless ones: light front-to-rear contact or minor bumps when parking the car. In the standard insurance-category crash test, with the car striking a barrier at 15 km/h and 40 percent overlap, the aluminium front cross-member with its mountings keeps damage low. The radiator and oil cooler remain intact, another reason for this being that a programmed breakaway point enables them to move back by 20 mm. In another standard insurance-category test, the rear bumper moves down and prevents damage to the sheet-metal body panels. In neither of these tests does the body structure suffer any damage.

The bumpers are bolted to the body and can be replaced at only moderate effort and expense. They make contact with the adjacent side panels at accurately matched zero-gap joint lines. To achieve this, the engineers have used special reamed bolts and quick-release fasteners. Here too, Audi's quality principles can be seen – and felt.

Rigidity: the basis for comfort and dynamic handling

A factor that influences the occupants' well-being to a decisive extent is the rigidity of the car's body. It is the technical starting point for the refinement that they experience in the new Audi A4, undisturbed by unpleasant noise or vibration. At the same time, the rigid bodyshell is the key to the car's outstanding road behaviour – ensuring smooth passage over all surfaces and sporty precision in its handling.

The engineers' task was to develop a body with minimum weight but high dynamic rigidity in all areas. Compared with the already excellent values achieved by the previous model, they

achieved a five percent improvement in this respect. Two factors govern dynamic rigidity: the position of the natural global frequencies and the quality of the vibration patterns.

In the case of the natural frequencies, the aim is to separate them clearly from those emanating from the axles and driveline. All these vibrations occur in the range below about 40 hertz. The human ear does not register them, but they can be felt at the car's so-called 'comfort points' – the floor pan, the steering wheel and the seats. If the interior mirror trembles, this is also a sign of body vibration. As on the previous model, Audi's development engineers have confined body frequencies on the new A4 to the calmer corridors remaining available between the engine and axle vibration frequencies.

The qualitative form taken by these vibrations are described by the engineers with the aid of torsion and flexing lines around the longitudinal axis. The flexing line for the new A4 has been raised by just under ten percent. Any further increase would have been pointless, but would have resulted in additional weight. The gain that was in fact achieved comes from the more homogeneous transition between the front end of the body and the floor pan. The two torsion rings in the structure – behind the rear seats and around the boot aperture – also have an important contribution to make. The firewall, a floor-level cross-member and the roof enhance the effect of these rings by acting as thrust fields.

The development team also attached great importance to local rigidity. All points at which force inputs taken place when the car is in motion were reinforced to the necessary extent. The aim was to prevent as much energy as possible from being transmitted further into the structure as a whole, and to distribute unavoidable force inputs among several noise and load paths.

For example, the front axle beam distributes the impulses it receives from the wheels into a multi-element structure consisting of the side-members and tunnel element. This greatly reduces tyre noise in significant body areas. The larger body cavities such as the sills and posts, which could also generate undesirable vibration, have been divided up by inserting a series of partitions.

The quiet interior: detail aero-acoustical work

The new Audi A4 is an extremely quiet car that pursues a smooth path through the air much as one would expect from a saloon in the large luxury category. Intensive detail work was carried out to reduce wind roar – the biggest source of noise above 120 kilometres an hour – significantly below the level encountered on the previous model. This work was facilitated by a special tool – the Audi aero-acoustic wind tunnel.

Wind tunnel testing, for example, determined the shape of the rain gutter strips on the A-posts. Their rounded section avoids objectionable turbulence despite their height. When parked, the windscreen wipers are shielded in a non-critical zone behind the edge of the bonnet, where they do not interrupt the car's elegant outline or obstruct the driver's field of view. The doors, with their integral window frames, remain firmly against the body sides even at top speed, and have two main seals to isolate the interior of the car hermetically from the outside world.

The basic version of the new Audi A4 achieves an exemplary drag coefficient of $c_D = 0.27$ – an unsurpassed value for a midsize saloon and, depending on which engine is chosen, between five and eight percent lower than the previous model. Although the wider body increases the frontal area from 2.14 to 2.19 square metres, overall drag has been reduced by three to five percent.

Virtual tools: airflow around the body

As in all development areas, Audi made extensive use of virtual tools and high-speed computers when shaping the body. During the concept phase, the very earliest stage in the process, numerical 3D flow simulation has now almost completely replaced the previous use of quarter-scale models, and makes aerodynamic conditions visible even in largely concealed areas of the body. This procedure rapidly established the difference in drag coefficient (c_D) between the draft designs with the best and worst airflows: in this case it was 0.025.

In the development work that followed, the aerodynamic engineers refined a number of details on the basic body. Among their most important work areas were the front apron, the side panels, wheel arches and wheel transition points and the exterior mirrors. Because of the larger field of view now called for by law, the mirror housings had to be distinctly larger than on the previous model, but by reducing their depth, the losses caused by airflow around the mirrors was kept to the same level as before. The standard mirrors on the new A4 have remote electrical adjustment, heating and integral LED flashers.

The development team added small spoiler lips to the rear lights: by causing the airflow to break away at the sides at a precisely defined point, they further improve directional stability. The boot lid was optimised in length, lateral curvature and shape in a complex series of work stages, so that the airflow remains consistently high when the car is being driven.

60 percent of total aerodynamic drag comes from the car's body: the majority of what remains is due to the underfloor area, with a major contribution from the wheels and wheel arches. By

providing a smooth underfloor over almost the entire area, the aerodynamicists succeeded in reducing the drag coefficient (c_D) by 0.039. This result also makes itself evident in the form of higher performance and lower fuel consumption: CO₂ emissions are reduced by about three grams per kilometre. The plastic underfloor panels also protect the sheet metal of the bodyshell and the mechanical assemblies against salt, moisture and stone impact, and allow the previous PVC underseal to be dispensed with.

To check that all the tough quality targets had been achieved, development work on the new Audi A4 included an intensive testing phase in all kinds of climatic conditions and on a wide variety of roads. During summer-season testing in particular, body quality was given close attention – good sealing to prevent sand and dust from entering, strength and overall behaviour on bumpy roads. The new Audi A4's test-driving program amounted to more than 15 million kilometres, including a million in city traffic and 1.6 million over rough surfaces.

Interior

More space, greater comfort and sporty elegance – Audi’s development teams have given the new A4 a bright, spacious interior ambience, with distinguished visual details, as always no compromises in the quality of workmanship and controls that can be understood and operated intuitively. At the customer’s request, a whole series of high-tech features previously encountered only on larger luxury cars can be added to the specification. Above all, whoever takes a seat inside the new A4 experience an effect typical of Audi – a feeling of being absolutely at home there from the very first moment.

The generous dimensions naturally make a big contribution toward this sense of well-being: the interior of the new A4, for all its generous space, is tailored to the occupants’ needs rather like a well-fitting suit.

The interior is distinctly larger than the previous model in every dimension: 20 mm longer at 1758 mm, 10 mm wider at 1410 mm and with a rear-seat width at shoulder height of 1380 mm, an increase of 23 mm.

Generous: more space everywhere

Headroom at the front and rear seats has also gone up by a few mm, though there is still ample space between the seat occupants’ heads and the roof lining. At the rear of this five-seater, even heavily built passengers will appreciate the freedom of movement that Audi has provided. **Legroom is now 908 mm, a useful 29 mm more** than before and a figure worthy of a car in the large luxury class. The rear seats, with their slight individual contouring, are also notable for sporty comfort: the seat cushions are soft but the side sections slightly firmer; there is plenty of space for the occupant’s feet under the front seat.

Thanks to the length of the doors and the wide angle to which they open, the rear seats can be reached and exited in comfort. The cup holders recessed into the door pockets can even hold large one-litre bottles. The rear footwells are illuminated, and a fold-out centre armrest provides extra comfort. Optional extras include an electric rear-window roller blind and manually operated blinds for the rear side windows.

Many welcome features have been provided for the front seat occupants. In addition to the cup holders in the large door pockets, there are two more cup holders of different sizes on the centre tunnel, a holder for sunglasses in the interior light module in the roof lining, a parking ticket clip on the sun visor and an unusually large glove box. An optional storage package

includes a cup holder in the rear armrest, two compartments under the front seats and nets on the front-seat backs.

A luxury extra for the front seats is a centre armrest that can be moved forward and back and varied in height. It includes a storage compartment and two useful 12V power sockets, and takes the place of the open tray on the tunnel. As a further option, the rear socket can be changed for one with a 230V output (110V in certain countries). 12-millimetre thick foam padding gives the centre armrest a pleasantly soft surface. This entire element is of such generous size because the new Audi A4 has an electromechanical parking brake, so that no space is needed for the conventional handbrake lever.

Installed low down and of ample dimensions, the front seats integrate the driver and passenger perfectly into the car's sporty ambience. Occupants of every size and stature feel immediately safe. Thanks to their ergonomic contours and upholstery, they support the occupant's body perfectly. Body mountings of complex design and the high quality of the foam upholstery filter out any vibration caused by the road surface. Height adjustment is a standard feature of these seats, and their head restraints can be pulled well up if necessary.

At the touch of a button: electric seat adjustment

In addition to the manually adjustable seats, Audi offers an electrically operated version with push-button control of height, fore-aft movement and seat back angle. The four-way lumbar support – a device that can also be ordered separately – is also operated electrically. A position memory function is available: it stores two preferred settings of the seats and outside mirrors. The optional seat heating, which thanks to Audi's typical attention to detail has six output settings, heats the seat cushions and seat backs.

On all seats, the visual impression and feel are enhanced by the neat seams, stitched with great precision and careful workmanship. The sports seats have particularly elaborate quilting, with boldly contoured side sections for good body location. The seat base can be altered in angle and the cushion extended forwards. On these seats, the electric four-way lumbar support is a standard item.

The climate-controlled comfort seats in the front are the highlight of the seating range. Their extensive technical features, controlled in this case via the MMI operating system, introduces all the luxury of a larger saloon model to the A4. They are upholstered in perforated leather and have small fans with six possible speed settings to ventilate the seat back and seat cushion. To avoid any risk of the seat occupant catching a chill, the seat heating is actuated

automatically below a given temperature limit. The electric lumbar support is standard on comfort seats.

Noble: upholstery and colour schemes

The A4 comes with leather upholstery as a standard seating feature and are upholstered in Milano leather, with four colours: black, pale grey, cardamom beige and – a new option – mustang brown. Audi offers the same colours together with luxor beige, another newcomer, if Valcona leather is chosen.

The colours and equipment lines available for the new Audi A4 also pursue a sporty, elegant approach. On the previous model, the interior was divided into two different colour zones, darker at the top and lighter below.

In the new model the upper zone is also lighter in colour, which makes the entire interior of the car brighter and accentuates the darker surfaces in the driving area and on the centre console.

Ergonomics: clearly defined interfaces

The sporty, clearly defined styling of the new A4 is continued systematically inside the car. The designers have aimed for an elegant form of division into specific zones and structures, in order to make the ‘man and machine’ interfaces self-evident and easily mastered.

The emotive reaction to the perfect ergonomics of the vehicle is to feel immediately at home at the controls. The driver’s hand drops instinctively to the short, sporty gear knob, and the positions and angles of the steering wheel and pedals are as if individually tailored for maximum convenience. The brake pedal is not as high as before in relation to the accelerator: only 35 instead of 50 mm, so that the enthusiastic driver can shift his foot from one to the other more rapidly.

The steering wheel has 60 mm of manual reach and 50 mm of height adjustment, with electric-motor locking. The sporty S line includes a three-spoke leather-covered sports steering wheel and a leather-trimmed gear-lever knob or selector lever; an aluminium gear lever knob is an option.

The standard steering wheel in the new Audi A4 is a three-spoke leather-covered multifunction sports steering wheel. This has small drums and pushbuttons in discreet chromed frames for the basic functions of the navigation system, radio, car phone and speech

dialogue system – a method of control that is as safe as it is convenient. On the A4 3.2 quattro, tiptronic shift paddles located behind the steering wheel are also standard.

Clearly oriented: the cockpit is angled toward the driver

The cockpit has a definite directional bias toward the driver, so that all the important functions are easily accessible. The instruments and the centre console, which is also inclined by eight degrees toward the driver, form a single visual entity. Complex graphics which frame the taut surfaces with dynamic lines and communicate the clear layout of the various zones are visual evidence of the athletic power and lightness that can be felt in every aspect of the new A4's character. In the door trim, for example, the door handle, trim strip, armrest and storage compartment are combined into a functional, attractive unit.

The chosen shapes, the materials and the way they are employed, the varied but always agreeable 'feel' of the surfaces – all these qualities taken together make the interior of the new A4 a satisfying experience for all the senses. An example of this is the zone around the monitor screen.

There is a lighting package that illuminates the interior with a large number of discreet spotlights (optional for 1.8 TFSI and 2.0 TDI). On the backs of the monitor screen and instrument panel, Audi has abandoned the use of cloth strips or buffers for acoustic insulation, and adopted a novel type of foam, which suppresses creaking or crackling sounds reliably over a temperature range from - 40 to + 90 Celsius. The already proverbial no-compromise standards of quality practised by the brand with the four-ring emblem call for pure high-tech methods without which the use of innovative technologies would simply not be feasible.

Precision details: even the rotary control knobs are typical of Audi

Many details in the new midsize Audi model show a family relationship with the larger A8, and achieve the same final touch of luxury as found there. All switches, for instance, have short travel and operate when a carefully defined amount of effort is applied. The rotary knobs move as smoothly and precisely as the mechanism of a fine watch, and their restrained 'click' is pure technical perfection interpreted in sound. Around the automatic air conditioning controls are red and blue semi-circular light-emitting diodes to identify the temperature ranges – another elegant and convincing detail.

The A4 has automatic air conditioning with a pollen and recirculated-air filter as standard equipment. This creates the best possible interior climate entirely automatically, and even

takes the angle of the sun's rays into account when determining the ideal settings. The powerful blower delivers large quantities of air quietly and efficiently.

The air conditioning system is an entirely new development, with ten percent more cooling power than the previous version and 20 percent higher operating efficiency. As a result it reduces the fuel consumption needed to operate it by an average of 0.2 litres per 100 kilometres. All the components of the refrigerant circuit together weigh only 9.4 kilograms.

As an optional extra, a luxury version, the deluxe automatic air conditioning system, can be ordered. It regulates the air temperature, airflow volume and air distribution separately in three zones for the driver, the front passenger and the rear-seat area.

An air humidity sensor helps greatly in preventing the windscreen from misting over, and separate outlets on top of the dash panel provide low-draught indirect ventilation. A further optional extra is a high-performance auxiliary heater and ventilation system that can be operated by radio remote control or programmed via the MMI operating system.

With its droplet-pattern recesses for the speedometer and revolution counter, the instrument panel exhibits several typical Audi features, although it is in fact an entirely new development. Between the two large instrument dials, which are clearly marked and easy to read, there is the driver information system; this is standard equipment in cars with a V6 engine, and is ideally placed in the driver's direct field of view. It supplies information from the in-car computer, radio, navigation, audio or telephone systems and also shows the outside temperature and any warning messages.

Seeing more: the monitor screen on the centre console

A further large display screen is standard in every new Audi A4. It is located in the upper part of the centre console, level with the instrument cluster, and is therefore extremely easy to see. The standard screen is a 6.5-inch colour, which displays information from the audio and air conditioning systems and provides a means of configuring the CAR menu settings – the level at which the customer can use the radio controls to change various lighting and locking functions. The large switches and pushbuttons of the standard audio systems with MMI operating logic are ideally accessible between the automatic air conditioning and the ventilation outlets.

If the new Audi A4 is ordered with the Navigation system, the MMI (Multi Media Interface) operating system on the centre tunnel is also supplied with 7-inch colour screen and Audi's AMI Audi Music Interface plus 6 stack CD player. Highly praised in many specialist

magazines' tests for its simplicity and ease of use, this system (first introduced in the A8) is clearly superior to those offered by competitors.

15 large pushbuttons and a volume control are grouped around a central rotary pushbutton. They are used to select the navigation, information, CAR menu, set-up, telephone, directory, CD/TV and radio functions in a convenient and above all intuitive way; their logic is understood immediately. All information is shown on the large monitor; in combination with the high-end installation, the DVD navigation system, this is a colour screen measuring seven inches diagonally.

Close to the MMI buttons is another large switch that controls the new electromechanical parking brake, another system adopted from the large luxury-car market and already fitted to the A8. Like the conventional handbrake, the parking brake's initial function is to prevent the car from rolling away, but it also has a number of additional functions.

The integral drive-off assistant supports the driver by releasing the parking brake at precisely the right moment when the car is set in motion. On uphill gradients, it prevents the car from rolling back. There is also an emergency brake function that brings the A4 to a standstill at a rate of no less than eight metres per second – scarcely less than a full brake application – if the conventional brake system should fail.

Audi hold assist is another optional extra. Once switched on, it provides assistance for the duration of the journey. It extends the functions just mentioned still further by assisting the driver at a standstill, in stop-and-go traffic and when setting the car in motion. After braking to a standstill, the device prevents the A4 from moving by means of brief impulses from the hydraulic brake system. If the available brake-system pressure is not sufficient, two further demands are issued by the ESP, after which the assistant actuates the parking brake. To drive off smoothly on a gradient, all the driver needs to do is to engage the clutch. This is detected by a sensor at the pedal. The computer assesses the selected gear, the gradient angle and the engine data and determines when the brakes should be released as the car starts to move.

A smart memory: the car key

The radio-operated key for the A4 is a totally new development. It has no projecting teeth and therefore cannot damage the lining of one's pocket. To start the engine, the clutch or brake pedal is depressed and the key simply pressed into the ignition lock. The new intelligent key memorises service information and fault messages which are of importance to the workshop. This simplifies and speeds up the reception procedure when the A4 is brought in for servicing work.

Audi can also supply the A4 with the luxury advanced key option. In this case the key can remain in the car owner's pocket; the engine is started and stopped at an elegant knob on the centre tunnel. The locks are released by the sensor as soon as the driver touches a door handle or the boot release button, and secured again by briefly pressing a button. For maximum theft protection, there is an electronic immobiliser of the latest generation and an optional anti-theft alarm.

The best view: xenon plus headlights

Audi offers its A4 customers more than one headlight system. The high-tech solution uses xenon plus headlights, which can also be combined with the adaptive light cornering system. In both cases dynamic headlight range control is an integral feature, and the beams are raised at speeds above 120 km/h for after-dark motorway driving.

All these luxury-model features in the new Audi A4 are based on intensive networking of the control units and data buses. To ensure that these highly complex electronics have no adverse effect on reliability, Audi has installed its own management system to monitor and regulate the energy consumption of the A4. The most important basic principle is that the battery should always have a minimum state of charge that is sufficient to start the engine reliably. This is ensured by a special off-load current management system that remains in effect when the A4 is parked out of use.

Dynamic Management, on the other hand, comes into use when the engine is running. It distributes the electrical energy generated by the alternator in the most effective way among the individual consumer systems. This is especially important in winter: if diesel-engine heater plugs, seat and rear-window heating and the headlights all operate together, they sometimes consume more current than the system can supply. To generate this extra current, Dynamic Management can also raise the engine's idling speed for a short time.

Engines

Higher power, lower consumption – the new Audi A4 is being launched with a choice of four vigorous but refined engines. All of them have direct fuel injection: the two petrol engines use FSI technology, the two TDI units the common-rail principle. All the four-cylinder engines are turbocharged. The splendid flow of power from these engines makes driving the new A4 pure pleasure. Yet at the same time they consume an average of nine percent less fuel than the corresponding engines in the previous model. For Audi, power and efficiency always belong together.

The new Audi A4 is being launched Down Under with a choice of two petrol engines.

The 3.2 FSI is a V6 developing 195 kW. The four-cylinder 1.8 TFSI has a power output of 118 kW. These engines are further proof of Audi's leading position in engine design. Both of them use the petrol direct injection technology known as FSI, which is superior to anything that their competitors have to offer. The naturally aspirated 3.2 FSI combines FSI with the innovative Audi valvelift system; the 1.8 TFSI has forced aspiration by turbocharger.

FSI injection technology injects fuel directly into the combustion chambers. This principle has thermodynamic advantages and operates at greater efficiency. FSI engines develop higher power and are more dynamic than conventional engines with fuel injection into the intake pipes – and also make more economical use of the fuel. This increase in efficiency once again provides evidence of the technological lead summed up in the Audi slogan “Vorsprung durch Technik”.

Petrol direct injection from Audi first demonstrated its potential for superior performance in June 2001, when an engine featuring petrol direct injection took the Audi R8 sports-car prototype to overall victory in the Le Mans 24 Hours. In the years that followed, the car was entered for 80 races and won 64 of them – evidence not only of the power developed by its engine but also of the refusal to compromise on reliability and quality that is typical of the Audi attitude to both motor sport and series production.

Top petrol-engined model: the 3.2 FSI

In the new Audi A4 model line, the top petrol engine is also new: the 3.2 FSI. This magnificent, highly refined engine has been extensively redesigned in comparison with the previous model. It now incorporates a complete package of high-tech features: the innovative Audi valvelift system, FSI petrol direct injection and various measures aimed at reducing internal friction and thus boosting efficiency still further.

A member of the modern Audi family of vee engines, the 3.2 FSI has a 90-degree included angle between the cylinder banks, compact dimensions and a low weight of just 171 kilograms. Its engine block is made from an aluminium-silicon alloy. This keeps the overall weight of the new Audi A4 low and gives it optimal axle-load distribution. The low weight also makes a direct contribution to the car's dynamic road performance.

The 3.2 FSI engine, with a displacement of 3197 cc, develops 195 kW and delivers its maximum torque of 330 Nm all the way from 3000 to 5000 rpm. It can accelerate the Audi A4 3.2 FSI quattro with manual gearbox from 0 to 100 km/h in only 6.2 seconds, and urge it on to its governed top speed of 250 km/h.

This imposing flow of power is linked to remarkably low fuel consumption. Compared with the previous model, which had a power output of 188 kW, fuel consumption has been reduced by an impressive 1.2 l/100 km, yet the 0-100 km/h acceleration figure has been cut by two tenths of a second. The 3.2 FSI quattro is available with tiptronic six-speed automatic transmission.

About half of the improvement in fuel consumption is due to the Audi valvelift system: with this new valve operating technology, the engine uses at least five percent less fuel. The Audi valvelift system, which controls valve lift in two stages, ensures excellent combustion chamber filling in all situations.

It regulates the amount of combustion air drawn into the engine by varying inlet valve lift; in most cases the throttle butterfly can therefore remain fully open, which largely eliminates undesirable throttling losses. The engine breathes more freely and develops higher power and torque, but consumes less fuel.

Brilliantly simple: actuation at the camshafts

Whereas previous valve lift control systems have needed complicated, clumsy elements between the camshafts and the valves, Audi has moved the actuating principle directly to the camshafts – a high-efficiency solution with the simplicity of genius. The V6 engine's inlet camshafts are provided with splines that carry cylindrical sleeves. These cam elements have two different profiles, one for low valve lift, the other for full valve lift. Metal pins actuated by an extremely rapid electronic shift system engage in spiral grooves on the sides of the revolving cam elements and displace them by seven mm along the camshafts.

During part-load operation, the lower cam profiles actuate the valves' roller cam followers. The valves then open by either 2.0 or 5.7 mm. This difference in valve lift introduces a controlled degree of turbulence in the mixture as it forms in the combustion chamber, and ensures particularly clean combustion. At full load, the larger cam profile comes into use, for a valve lift of 11.0 mm. The changeover takes place at any engine speed between 700 and 4000 rpm, and is completed within two turns of the crankshaft.

A series of accompanying measures are applied by the new, highly intelligent engine management system to make the transitions smooth and unnoticeable. All the driver senses is an unbroken, turbine-like build-up of power and spontaneous response to the accelerator.

Thanks to its uncomplicated layout, the system is rated for engine speeds up to almost 7200 rpm, so that high power outputs are possible. The Audi valvelift system achieves its greatest potential for fuel economy at constant road speeds in the moderate part-load operating range. If it is driven smoothly at 150 km/h in sixth gear on a motorway, equivalent to an engine speed of approximately 4000 rpm, the engine will operate in the low valve-lift setting.

A technological leap forward: petrol direct injection

FSI petrol direct injection is another major step forward in automotive technology: it injects the fuel directly into the combustion chambers at pressures of up to 100 bar. As the fuel evaporates, it draws heat out of the combustion chamber surface. This permits the high compression ratio of 12.5 : 1 to be used, which greatly increases combustion efficiency. Depending on load and engine speed, an electronically controlled flap in the plastic intake pipe switches over from the longer air-intake path that increases the engine's pulling power to a shorter path for maximum power output.

Design progress in other areas on the 3.2 FSI engine concerns for instance the timing chains that drive the camshafts. As is typical of Audi vee engines, they are located at the rear of the engine in order to save space. The sprockets and intermediate gears now have more teeth, for quieter running and reduced loads on the chains. A similar effect is achieved by the tri-oval, i.e. very slightly triangular, shape of the chain sprockets. The three single-roller chains are also of new design, for smooth running and maximum wear resistance. They need no routine maintenance and do not have to be changed throughout the engine's operating life.

The oil pump has also been extensively modified. Its delivery volume has been reduced by 30 percent, and it now operates by varying the volumetric flow according to actual demand. At an engine speed of 4600 rpm, the pump switches from the low to the high pressure stage, after which the oil spray jets for the underside of the piston crowns are brought into action to avoid

peak temperatures. A combined coolant radiator/oil cooler is installed immediately adjacent to the pump.

Taken together, all these measures – which include a smaller water pump and reduced piston-ring pressure – have significantly reduced the engine's friction losses. The mean friction pressure at 2000 rpm has gone down by 0.22 bar, equivalent to 25 percent. This has yielded a fuel saving of approximately five percent.

FSI injection technology and turbocharging: the 1.8 TFSI engine

The smaller of the two petrol engines also underlines Audi's leading position in engine design. The 1.8 TFSI combines the valuable advantages of direct injection and turbocharging into an ideal technical package that provides sporty driving fun allied to low fuel consumption and emissions. This four-cylinder engine develops 118 kW and has the high maximum torque of 250 Nm, which remains available over the entire engine-speed range from 1500 to 4500 rpm.

This turbocharged direct-injection engine gives the new Audi A4 ample performance. The version with six-speed manual gearbox has a top speed of 225 km/h and accelerates from a standing start to 100 km/h in 8.6 seconds. Yet the A4 1.8 TFSI limits itself to just 7.1 litres of fuel per 100 kilometres, 1.1 l/100 km less than the previous model. With a compression ratio of 9.8 : 1, the engine is ideally designed to run on PULP (95 RON). As an alternative to the manual gearbox, Audi also offers multitronic continuously variable transmission on this model; both four-cylinder cars' transmission options drive the front wheels.

For the 1.8 TFSI, Audi's engineers have carried out intensive development work on the concept first introduced three years ago as the 2.0 TFSI. Since 2005, the two-litre engine has been voted 'Engine of the Year' three times in succession by an international jury of journalists. **Despite its lower displacement, the turbocharged 1.8 TFSI delivers as much power as a naturally aspirated V6 only a few years ago, but consumes far less fuel.**

Weight saving with grey cast iron: the engine block weighs only 33 kg

The 1.8 TFSI engine block has little in common with the previous engine apart from the 88-millimetre cylinder spacing. The crankcase is of grey cast iron, which has good noise-absorbing properties. It weighs only 33 kilograms, and the complete engine tips the scales at a mere 135 kg.

There are two contra-rotating balancer shafts in the crankcase, to suppress the free second-order inertial forces generated by this type of engine. The rigid basic structure of the block and its optimised add-on elements and covers also help to eliminate drumming and vibrations.

The chain that drives the balancer shafts has also been designed for quiet running. A further chain runs to the oil pump: this has volume-regulated delivery and two-stage pressure control, and cuts fuel consumption by 0.2 l/100 km. A third chain drives the two camshafts. A new development is the extremely responsive adjuster that turns the inlet camshaft steplessly through up to 60 degrees of crankshaft rotation. To keep the dimensions compact, the mounting for the auxiliaries holds the oil cooler, the oil filter and the two oil-pressure switches, with the oil filter positioned upright so that it is extremely accessible and time and expense are therefore saved when the car is being serviced.

For the 1.8 TFSI, Audi's engineers have increased the fuel injection pressure to 150 bar. The high-pressure pump, a new development, is driven by a four-lobe cam on the exhaust camshaft. The six-hole injectors, which are also new, distribute fuel accurately in the combustion chambers so that an efficient combustion process can take place. Double injection strokes (during the induction and compression strokes) are performed after starting a cold engine.

This too is to ensure that combustion is clean and stable, and to raise the ceramic catalytic converters, which are located close to the engine, to their regular operating temperature as quickly as possible.

Combustion air is supplied to the cylinders by a Borg Warner Type K03 water-cooled turbocharger. Its turbine casing is integrated into the exhaust manifold to form a single high-alloy grey cast iron module. An optimised turbine wheel improves initial response at low engine speeds. At 2000 rpm, the 1.8 TFSI needs only 1.2 seconds to build up its maximum torque of 250 Nm. The previous 1.8-litre engine needed 1.7 seconds to reach its maximum torque of 225 Nm.

In the air intake system of the 1.8 TFSI, a new design of charge-movement flap valve generates the turbulence needed to create a high-quality, homogeneous fuel-air mixture. The charge-air intercooler is also a new development and is notable for its high efficiency at low weight and for its compact dimensions. All the turbocharged engines for the new Audi A4 have the intercooler mounted below the front bumper cross-member and ahead of the radiator, a position which locates it in the airflow from the cooling fan.

Drivers of the new Audi A4 1.8 TFSI will experience all these advanced technical features quite simply as pure driving pleasure. The four-cylinder engine responds willingly and unhesitatingly to accelerator pedal movements at all engine speeds. A very smooth-running unit, it pulls lustily from idle speed upwards; it has far more character than its entry-level status would suggest.

A tradition of leading-edge design: Audi TDI engines

For the past 18 years, Audi's TDI engines have set the standards in every market segment in which they are represented. Their high torque, extremely low fuel consumption and quiet, refined running are evidence that the overall concept is harmonious and convincing. Audi introduced the TDI principle to the market as long ago as 1989, and since then the brand with the four-ring emblem has steadily built up its lead in this technological area. All the TDI engines for the new A4 have diesel particulate filters as standard equipment and are already prepared for compliance with the forthcoming Euro 5 emission limits.

Audi is launching the new A4 with a choice of two diesel engines – a V6 unit and a four-cylinder inline engine. The V6 TDI engine (arriving late May 2008 in Australia) is from the Audi vee engine family, which features a 90-degree included angle between the cylinder banks. With displacement of 2.7 litres, they are compact and light in weight. Its high power and torque makes it ideal for a modern, powerful form of sporty driving, and indeed two Le Mans race wins by the R10 racing car in 2006 and 2007 are ample evidence of the power that the Audi TDI principle can deliver. The four-cylinder, two-litre TDI engine now has a new common-rail injection system using piezo injectors; it too runs quietly, smoothly and efficiently.

Effectively new: the 3.0 TDI (available in Australia from October 2008)

The three-litre diesel has been so thoroughly revised in design that it can be regarded as a largely new engine. It now develops 176 kW and has an impressive maximum torque of 500 Nm. This ultra-powerful TDI, which has a displacement of 2967 cc, makes the new A4 even more of a sports saloon. It accelerates from 0 to 100 km/h in only 6.1 seconds, and has a top speed of 250 km/h – yet the average fuel consumption is a mere 6.9 l/100 km. The 3.0 TDI is supplied with quattro permanent four-wheel drive and a six-speed manual gearbox.

Compared with the engine in the equivalent preceding model, which developed 171 kW and consumed 7.5 litres of diesel oil per 100 km, maximum torque is now 50 Nm higher, and is at the driver's disposal all the way from 1500 to 3000 rpm. This is the key to the surge of power – a wave on which the car, like a surfboard, seems to be carried forward in a relaxed, carefree

way. The maximum engine speed is also 400 revolutions per minute higher, with the full rated power output available from 4000 to 4400 rpm.

The V6 TDI has an engine block made from vermicular-graphite cast iron, a lightweight material. It is extremely rigid – an essential for smooth running. The pistons have friction-optimised rings, and the chain drives to the camshafts and auxiliaries have also been improved.

Fuel injection on the V6 TDI engine is by a third-generation common-rail system with eight-hole injectors. It operates at a high pressure (up to 1650 bar, and equivalent to the entire weight of the car resting on a surface only one square centimetre in area), which ensures even finer atomisation of the fuel, better mixture formation and more efficient combustion. The injectors use the piezo principle, which changes the structure of a ceramic element when an electrical voltage is applied. The resulting expansion is transmitted to the injector needle. The injectors close again after only one to two thousandths of a second, so that very small quantities of fuel weighing only 0.8 mg (less than a thousandth of a gram) can be injected reliably.

Thanks to the extremely fast, precise switching action of the piezo injectors, the number of injection strokes per working cycle can be widely varied on the 3.0 TDI engine, up to five are possible. This strategy reduces emissions and makes the combustion process smoother, so that the engine's noise pattern is also more satisfactory. The three-litre diesel is the best performer in its class in terms of refinement.

New components: turbocharger and charge-air intercooler

The 3.0 TDI engine uses the latest type of VTG (variable turbine geometry) turbocharger. A fast electric adjusting motor moves its guide vanes, so that high torque builds up freely and spontaneously. The turbocharger is located in the vee between the cylinder blocks. The charge-air intercooler is also new. It is installed transversely ahead of the radiator in an ideal position for optimal cooling, and has a high thermal efficiency rating. The charge air supplied to the engine is cooled from 184 down to 69 degrees Celsius. Cooling the airflow compressed by the turbocharger increases the volume of charge air entering the cylinders.

The revised 3.0 TDI is notable not only for its low fuel consumption but also for its especially clean exhaust: the limits that will apply when Euro 5 legislation comes into force are already complied with. A new exhaust gas recirculation concept reduces emissions of oxides of nitrogen. It has a much higher cooling rate, thanks to greater EGR cooler efficiency and reduced flow resistance.

A diesel particulate filter is used to reduce soot emissions: it cuts the already low level of untreated emissions further, by more than 90 percent. The filter is installed close to the engine, so that only a small amount of heating energy is required for its regeneration. A small oxidating catalytic converter is installed ahead of the particulate filter: since it is located directly after the turbocharger, it also benefits from the rapid heat build-up.

When engines are developed, the demand for higher power, lower fuel consumption and reduced pollutant emissions are clearly contradictory. However, with the developed version of the 3.0 TDI Audi demonstrates most impressively that within this conflict of requirements all the main parameters can be improved at the same time – further evidence of the brand's leading position in the TDI sector.

Breakthrough: the world's cleanest diesel

The new Audi A4 3.0 TDI with ultra-low emission system is a further step forward that demonstrates the potential of the Audi TDI principle: from mid-2008 on, the world's cleanest diesel will be available in the sportiest midsize saloon. It will arouse enthusiasm not only because of the dynamism promised by a power output of 176 kW and the outstanding torque of 500 Nm, but also because of its modest fuel consumption and extremely low emissions. The A4 3.0 TDI with ultra-low emission system complies with statutory limits that will not become compulsory until 2014.

The ultra-low emission system raises the principle of the direct-injection turbocharged diesel to a new level. In developing it, Audi's engineers have combined a whole package of innovative measures. A new common-rail fuel supply system, piezo injectors operating at a pressure of 2000 bar, high-efficiency exhaust gas recirculation and further optimised forced aspiration join forces to achieve a significant reduction in untreated emissions. A further Audi innovation introduced for the first time is the addition of pressure sensors in the combustion chambers: they permit combustion processes to be controlled even more precisely.

A further technical breakthrough is the actual exhaust purification system, which cuts emissions of oxides of nitrogen (NO_x) by as much as 90 percent. This system operates with the additive AdBlue, an aqueous 32.5-percent solution of carbonic acid diamide, small amounts of which are injected ahead of the De NO_x catalytic converter. This injection process is precisely timed, since for a high conversion rate it is important for the AdBlue solution and the gas flow reaching the entry surface in the converter to be continually matched. In the hot exhaust gas, the solution decomposes into ammonia, which breaks the oxides of nitrogen down into nitrogen and water.

For the winter: heated pipes

The complete system consists of the catalytic converter, the metreing module and the AdBlue tank. The AdBlue solution has a freezing point of -11 °C, so that both the active tank and the metreing line and pump have to be heated at low outside temperatures. This function is activated automatically by temperature sensors. The regulating sensors are also complex: two NO_x sensors measure the concentration of the oxides of nitrogen ahead of the diesel particulate filter and after the ultra-low emission system; system functions are also monitored by pressure and temperature sensors.

The AdBlue tank, like the fuel tank, is filled at the fuel filler flap. The reservoir volume of approximately 22.5 litres is divided between two tanks: the active tank below the fuel filler flap has a capacity of 7 litres, the passive tank under the floor holds 15.5 litres. The AdBlue solution, which is biodegradable, is added as a routine operation each time the car is serviced, without the customer having to take any action. Since consumption of the solution is very low, Audi can guarantee that the amount carried on the car will be sufficient from one workshop visit to the next. The system is rated to perform reliably for the car's entire operating life.

The exhaust system is completed by two conventional catalytic converters, installed ahead of the ultra-low emission system. The oxidating converter transforms hydrocarbons and carbon monoxide into carbon dioxide and water. The diesel particulate traps particles in the gas flow and collects them in the structure of the filter.

Thanks to their extremely low emissions, Audi is able to sell its clean direct-injection diesels all over the world, even in the US states of California, Massachusetts, Maine, New York and Vermont where extremely stringent emission limits apply. From 2010 on, Audi will be offering this new technology in further car and power-output classes. The brand is pursuing a systematic work strategy aimed at lowering fuel consumption and pollutant emissions still further. By 2012, Audi will have reduced its models' CO₂ emissions by some 20 percent – yet their sporty character will be enhanced at the same time.

Highly efficient: the 2.7 TDI

The first V6 TDI available in Australia for the new A4 model line is slightly more economical than even the 3.0 TDI, with an average fuel consumption of no more than 6.6 litres per 100 kilometres. Like the 3.0 TDI, the 2.7 TDI already complies with future EU 5 limits. A major element in achieving this has been the Bosch piezo common-rail system, which uses injection pressures of up to 1800 bar.

The 2.7-litre engine, like the larger unit, is from the Audi vee-engine family. It has a power output of 140 kW and delivers a massive 400 Nm of torque all the way from 1400 to 3250 rpm.

The 2.7-litre engine has a stroke of 83.1 mm, 8.3 less than the 3.0 TDI. With the unchanged bore of 83.0 mm, this yields a displacement of 2698 cc. The engine's performance has also been boosted beyond the previous version's figures of 132 kW and 380 Nm, yet at the same time its fuel consumption has gone down by 0.2 l/100 km. The A4 2.7 TDI reaches 100 km/h in a brisk 7.7 seconds from a standing start, and has a top speed of 226 km/h. It has multitronic continuously variable transmission and front-wheel drive – a technical package for customers who value a car with an easy-to-operate, relaxed, refined driveline.

Further improvements all round: the 2.0 TDI

The 1968 cc four-cylinder TDI ushers in a new generation of efficient, dynamic diesel engines from Audi; it is a new interpretation of the TDI concept's outstanding qualities. This two-litre unit builds on the characteristic strengths of its predecessor, which was the highest-volume production diesel in the world, and offers customers even more driving fun, economy and refinement.

For use in the new A4 the 2.0 TDI has been given common-rail fuel injection, the piezo injectors of which operate at a maximum pressure of 1800 bar, and a whole series of additional innovations as well. This two-litre engine also complies with future EU 5 emission limits.

The 2.0 TDI is both refined and powerful: it develops 105 kW and delivers its maximum torque of 320 Nm at all engine speeds between 1750 and 2500 rpm – enough to hustle the Audi A4 in 9.4 seconds from a standing start to 100 km/h and for it to reach a top speed of 215 km/h. This four-cylinder diesel is available with multitronic continuously variable transmission and front wheel drive.

In the new Audi A4 the 2.0 TDI engine is installed at an angle of 20 degrees to the right, which has necessitated certain changes to the oil sump and crankshaft. The most interesting development, however, concerns the cylinder head, in which the two overhead camshafts operate 16 valves, and common-rail injection controlled by one of the most modern engine-management systems on the market supersedes the previous pump-injector units.

Like the 3.0 TDI, the 2.0 TDI features modern piezo injectors and eight-hole injector nozzles. The degree of precision to which up to five injection strokes per operating cycle can be

modulated has the effect of audibly reducing the noise level. The single-piston high-pressure pump builds up a full system pressure of 1800 bar, which results in very fine atomisation of the fuel and accurate, efficient combustion.

The acoustics of the toothed belt drive have also received attention, with additional noise-reducing structures on the belt cover. As on the previous engine, two balancer shafts reduce the vibration generated by the crankshaft and reciprocating parts.

The 2.0 TDI, which has a 16.5 : 1 compression ratio, has a number of other special features that also improve its performance potential. Its turbocharger is from a new design generation. So that torque builds up more rapidly, it has adjustable guide vanes on the turbine side, and a pulsation damper to reduce vibration. Electric motors control the position of the swirl flaps in the intake pipe: these modify the incoming airflow continuously to match engine load and speed.

Free-revving: the limit is not reached until 5000 rpm

Optimised intake-air management and modified piston geometry have put the maximum engine speed up to 5000 rpm, and have in particular improved the thermodynamic situation in the combustion chambers. As a result of these measures, the two-litre TDI can be operated with a high rate of exhaust gas recirculation (up to 60 percent); combustion takes place at a lower temperature and oxygen level, so that untreated emissions of oxides of nitrogen are lower. To achieve this, Audi has given the four-cylinder engine a switchable EGR (exhaust gas recirculation) system that has a high cooling rate. The oxidating catalytic converter has been improved and combined into a single unit with the maintenance-free diesel particulate filter. Both of them are located close to the engine and therefore reach their operating temperature quickly.

The 2.0 TDI already complies with the EU 5 emission limits that will probably come into force in 2010, and which will call for a further reduction in the level of oxides of nitrogen. This makes it necessary to reduce the combustion temperature, although this in turn has a negative effect on efficiency. By concentrated attention to design details, however, Audi's engineers succeeded in averting the risk of poorer fuel consumption and in fact achieved a slight improvement in this respect.

Transmissions

Those who buy the new A4 have the choice between various high-tech transmission systems. Either a manual gearbox or an automatic transmission transmits engine torque to the front wheels, or to all four wheels by way of the quattro driveline, the settings of which are incidentally more dynamic than ever before in this new Audi saloon.

Dynamic, sporty driving and a luxury-car standard of comfort – this ambitious combination of objectives was pursued when developing the driveline for the new Audi A4 as well. The manual gearbox (1.8 TFSI) is a totally new design; the six-speed tiptronic and multitronic continuously variable transmissions have undergone an extensive improvement process. All the transmissions are notable for exceptional ease of control, high efficiency and precise function. They conform to the A4's new basic layout with the differential immediately behind the engine and therefore ahead of the clutch or torque converter.

The quattro permanent four-wheel-drive system has been a sporty classic in the Audi product portfolio for many years. The new A4 3.2 FSI and the A4 3.0 TDI have this driveline as standard equipment. For the new saloon, the technology of the quattro driveline, with its asymmetric/dynamic torque split, is sportier and more fascinating than any previous A4.

The manual gearbox

The six-speed manual gearbox that transmits power to the road wheels on the A4 1.8 TFSI has been newly developed and can transmit up to 350 Nm of torque. The manual gearbox is installed with the differential ahead of the clutch. Drive from the gearbox to the differential is by way of a hollow shaft inclined at an angle of 7.2 degrees, with special splines at both ends. The dual-mass flywheel and the hydraulically actuated single dry-plate clutch are not bolted to the crankshaft in the usual way, but supported on the gearbox input shaft.

Various measures have been taken to reduce internal friction and thus improve the already high efficiency of the gearbox still further. Special selector fork mountings decouple the gear lever from the driveline so that the driver does not sense any vibration. What he or she does enjoy is a precise shift action with short, clearly defined lever movements.

For manual versions of the new A4, the driver information system features a factory-fitted gearshift indicator to make it easier to select the correct gear for maximum economy. It indicates which gear is actually in use, and if a different gear would be more suitable while the car is being driven at a steady speed, makes the appropriate recommendation.

Further intensive development: tiptronic

The new A4 3.2 FSI is available with the quattro driveline as standard equipment and six-speed tiptronic automatic transmission. This classic automatic transmission, with the Sport program and the additional manual-shift mode, has been thoroughly revised in design in the transfer-case and torque-converter areas.

The torque converter is now equipped with a novel form of two-stage torsional vibration damper that permits the lock-up clutch to remain engaged for long distances. This boosts overall efficiency and reduces the car's fuel consumption. When the car is at a standstill, a controlled drive-off clutch disconnects the transmission from the engine even if the selector lever remains in position D. This clutch is engaged as soon as the driver releases the brakes.

For the new Audi A4, the tiptronic transmission is distinctly more dynamic than the version used on the previous model; it reacts more rapidly and performs much faster shifts without any lack of refinement in the way that these are carried out. These improvements are due to an improved layout of the oil passages used to fill the converter, and more powerful software for the Dynamic Shift Program (DSP), which uses an adaptive operating principle. During an upshift the control unit now lowers engine torque by as much as 80 percent, and during a downshift it opens the throttle for a predetermined time.

multitronic: seamless

Audi offers the multitronic continuously variable transmission for the A4 1.8 TFSI, A4 2.0 TDI and A4 2.7 TDI; it combines the advantages of a manual gearbox with those of a conventional automatic transmission with torque converter. The highly convenient but also extremely dynamic acceleration it offers make it ideal for the sporty driver who values relaxed, stress-free travel. With its high efficiency and widely spread ratios, multitronic ensures that the engine runs in its optimal operating range whenever possible and thus keeps fuel consumption low. Internal losses have been reduced still further by improvements to component geometry, the shaft bearings and the design of the oil pump.

The multitronic's new variator permits a wider spread of transmission ratios: 6.73 instead of the previous 6.25 between the highest and lowest ratios. In the lowest ratio the A4 accelerates powerfully, whereas the highest enables the engine's fuel-saving potential to be fully utilised even at low engine speeds. The drive-off ratio has been specially lowered so that the A4 sets off vigorously from a standing start. The multitronic transmission has an adaptive control system that varies its settings according to driving style and road topography.

In the D mode of this successful unit, the effective transmission ratio changes steplessly, but a button can also be pressed to activate the dynamic Sport program, which selects lower ratios in all circumstances. When accelerating, the fixed characteristics of the Dynamic Shift Program select eight specific ratios in succession – an impressively sporty way to make rapid progress. The third operating mode has provision for manual selection of these eight fixed ratios by the driver, either at the selector lever or as an optional extra at shift paddles behind the steering wheel.

Unsurpassed: the quattro driveline

The new Audi A4 3.2 FSI and 3.0 TDI always transmit their power to the road by way of quattro permanent four-wheel drive. This gives the cars the supreme capabilities that have become an Audi trademark in the years since this driveline was first introduced in 1980: enhanced traction, road dynamics, safety and directional stability – together making up Audi's proverbial 'Vorsprung durch Technik'.

The quattro models in the new A4 line are dynamic saloon cars with unshakable stability in all weather conditions. And thanks also to their powerful engines, they are also ideal for towing a trailer.

In the new Audi A4, as before, the key element in the quattro driveline is a centre differential: this is a self-locking worm and wheel device. It is a purely mechanical unit and therefore takes effect without the slightest delay. Its locking action only develops in response to an applied load; when braking or cornering, it permits the wheels to rotate at different speeds.

In normal driving conditions, 40 percent of engine power reaches the front wheels and 60 percent the rear wheels, permitting sporty handling with slight rear-end emphasis. Should the wheels on any axle start to spin, however, the differential redirects most of the torque to the axle revolving more slowly and therefore with better traction.

The centre differential can direct up to 65 percent of the power to the front axle and up to 85 to the rear axle; as a result, the new A4 can often master situations close to the handling limit without ESP having to make a brake application. If one wheel on an axle begins to spin, this is eliminated by the electronic differential lock (EDL) without any brake application being needed – though this situation seldom arises. EDL also acts as an aid when driving off.

Dynamic suspension

The dynamic suspension on the new Audi A4 sets higher standards than ever before, combining precision and dynamism with a high level of stability and a supreme sense of control. It has been entirely redesigned, with suspension mountings, steering, wheels and brakes developed for top performance and many aluminium components used to keep unsprung weight to a minimum. Two innovative technologies make the driving experience even more fascinating: the Audi drive select adaptive regulating system and Audi dynamic steering. The new Audi A4 – the new way to drive.

The five-link front suspension makes a considerable contribution to the car's dynamic character. By moving the differential to the front and the clutch to the rear, the design engineers were able to reposition the front axle 154 mm farther forward – a design approach that Audi introduced for the first time on the current A8 model. Together with relocation of the car's battery in the boot, it optimises front and rear axle-load distribution.

Since the engine's weight is on the front wheels, good traction is assured; front-wheel drive has proved its superiority in terms of safety, directional stability and performance in winter. It is only surpassed by the quattro versions of the new A4; since this special driveline concept includes an additional differential at the rear, weight distribution is even better balanced.

Even when seen at a standstill, the new Audi A4 displays the principal aspects of its character for all to see: the wide track (1564 mm at the front, 1551 mm at the rear), the large wheels and the short body overhangs are visual expressions of dynamic, sporty character. On the road, drivers will find that the A4 is the sportiest of the midsize saloons – an agile car that can be guided and positioned with effortless ease. The A4 responds willingly and eagerly to steering-wheel movements and handles in an almost neutral manner as the limits are approached. It exhibits very little understeer and maintains maximum traction when leaving a corner.

The hard core: the front-axle subframe

The largest and most complex component in the entire running gear is the aluminium support beam for the engine and the front suspension assemblies. It is bolted rigidly to the front end of the car and thus forms part of the body structure. Thanks to its high rigidity, steering movements are carried out promptly and accurately. On the new Audi A4, aluminium is also used for the bearing mount that links the upper suspension control arms with the body, and for the pivot bearing. The latter is manufactured by a combined casting and forging technique that gives it very high strength.

Each front wheel is located by five suspension links – a support link and a control arm at the bottom and two control arms at the top. The fifth link – the track rod – connects the steering box and the pivot bearing. All these links are made of forged aluminium, to keep unsprung weight low, provide ultra-precise wheel control and ensure a high level of crash safety. To save weight, the anti-roll bar is actually a high-strength tube.

The geometry of the upper and lower control arms enables the virtual steering axis – a value obtained from an imaginary extension of the control arms to the point where they intersect – to be close to the wheel centreline. This reduces the leverage exerted by driveline and external forces, so that the driver does not feel them at the steering wheel.

The front-axle kinematics on the new Audi A4 have a series of additional advantages. The camber and caster angles can be chosen for precise centring of the steering, which adds to the sense of steering accuracy around the straight-ahead position. Toe angle changes in response to lateral forces were chosen for a harmonious initial steering response even at high speeds. The generous diameter of 102 mm increases wheel-bearing life.

The five-link suspension with its tapering control-arm layout handles longitudinal and lateral forces separately when the car is in motion. The bearings are rigid in a lateral direction, to promote sporty precision and permit high cornering speeds. Longitudinally, however, they are softer and suppler; in this way the dynamism of a sporty saloon and the ride comfort of a luxury car are combined in the new Audi A4.

Design breakthrough: the low-mounted steering system

The steering system used on the previous model was also extensively revised, the decisive step being its repositioning. It was previously high up and well to the rear, above the gearbox and attached to the base of the radiator water chamber. It is now farther forward and lower, on the subframe just below the front axle.

Since movement of the steering wheel is transmitted to the wheels in a very direct manner by the track rods, steering response is immediate, and feedback from the road surface precise and well differentiated. Friction-optimised track rod joints, lubricated with a special grease, add to this desirable level of sensitivity.

The steering column has a torsionally-rigid bolted joint at the cross-member below the windscreen and the bearing mount on the firewall, which also makes steering response more precise.

The standard power steering has a rack and pinion mechanism in an aluminium casing. With an overall ratio of 16.1:1, the steering is sporty and direct, but with no hint of nervousness. A controlled-output vane-type pump supplies the necessary hydraulic energy; unlike conventional power-steering pumps, which circulate a large volume of oil internally, it delivers only as much oil as is needed in any given operating situation. This reduction in energy consumption lowers the fuel consumption of the new Audi A4 by 0.1 litres/100 km.

In addition to the standard power steering, Audi offers a further technological alternative. The A4 3.2 FSI, A4 2.7 TDI and A4 3.0 TDI are equipped with servotronic power steering, with the degree of power assistance dependent on road speed. When parking the car, this system makes the operation more agreeable by reducing the effort needed at the steering wheel, whereas at higher road speeds the necessary effort is increased to ensure maximum precision.

Perfect ground contact: the rear suspension

Springing, wheel location, self-steering action – the rear suspension in the new Audi A4 fulfils all these tasks magnificently. The design engineers have based it on the toe-controlled trapezoidal layout chosen for the largest A6 and A8 model lines – with compact dimensions and excellent ride quality and comfort. The suspension kinematics for the A4 were nonetheless computed without reference to any other models – specifically for this car.

The backbone of the rear suspension is formed by a subframe resistant to torsional and bending loads. It is welded together from two longitudinal and two lateral tubes of high-strength steel, the longitudinal tubes being produced by the internal forming method using water at very high pressure.

This subframe is attached to the bodyshell by four large rubber mountings; these are extra-firm laterally for dynamic handling, but softer in the vertical and longitudinal directions for reasons of ride comfort. All the suspension control arms are acoustically decoupled from the axle subframe by means of elastomer bushings.

If sporty handling is to be combined with a high standard of ride comfort, the unsprung masses must be kept as low as possible. Audi has pursued this approach for all the rear-axle components. The two trapezoidal links are warm-hardened aluminium castings; the wheel carriers are of chill-cast aluminium. The upper control arms and the track rods are aluminium forgings. Their high rigidity ensures that toe and camber angles change very little when dynamic forces act on the wheels. The anti-roll bar, in fact a tube as at the front axle, also combines low weight with high rigidity.

The installed position of the suspension springs is entirely new. They no longer act on the trapezoidal links as on the previous model, but directly on the wheel carriers. The designers adopted this layout because it enables the new Audi A4's ride comfort to be raised to luxury-car level and at the same time the road dynamics of this sports saloon to be improved still further.

Separate spring and shock absorber mountings improve initial response, and as a further contribution to ride comfort, suspension travel has been increased by 20mm. The suspension bushings use special rubber mixtures that also enhance ride comfort. A novel type of elastomer element in the wheel carrier has a damping effect on vibration generated by wheel rotation. The rear suspension kinematics control brake dive closely and in this way also add to the car's sporty, dynamic appeal.

Taut and designed for speed: the sports suspension

Audi also supplies the new A4 with sports suspension as an option, offering firmer springs and shock absorbers, and reducing the body's ride height by 20 mm. The lower centre of gravity gives the car even greater visual tension and dynamism. Those who wish to intensify the car's sporty character to an even greater extent will choose the S line sports suspension. This has even firmer damping, and the car's body is lowered by a further 10 mm.

The compact trapezoidal-link suspension has notable packaging advantages. The floor of the boot in the new Audi A4 is low and flat, with a load-through width of 100 cm. Front-wheel-drive and quattro models have axles of almost identical construction, differing only in minor details: the subframes of quattro models, for instance, have an additional mounting for the rear-axle final drive.

A new dimension: Audi drive select

Audi drive select is not just a system that makes driving even more fun - it is a breakthrough in the midsize car segment and enables the A4 to explore entirely new dimensions. Audi drive select integrates the technical components that govern the driving experience into a single system including engine, automatic transmission, steering and the new adaptive shock absorber control; these modules, however, can be ordered separately.

By means of buttons on the centre console, the driver can influence the operation of the various components by choosing from three main modes, from 'Comfort' and 'Automatic' to 'Sport'.

If the full version of this system is ordered in conjunction with MMI, the driver can even compose a specific profile that suits his or ideal personal preferences. Audi drive select makes up to four individual cars out of the new Audi A4.

Two versions of Audi drive select are available. Three systems are integrated into the first version - the engine's response characteristic when the throttle is opened, the speed-dependent power assistance provided by the servotronic power steering and the automatic transmission's shift points, as well as the dynamic steering and/or the damping control can all be determined in three main programmed 'maps' that are quite different from one another in nature – these are Comfort, Automatic and Dynamic.

The 'comfort' mode is ideal for relaxed progress on long journeys and over poor road surfaces; 'dynamic' is the most balanced setting and 'dynamic' the boldly contoured, firm stage in which the new A4's running gear can demonstrate the full scope of its talents.

Changes from one characteristic to another are made at two arrow buttons on the centre console; the active mode is illuminated. All such changes are performed safely and smoothly: the driver can easily distinguish them but is not irritated when they take place.

For individualists: the personal Drive Select profile

If the A4 is also equipped with MMI and therefore has a navigation system on board, the driver has access to a fourth set-up level known as 'individual'. This can be configured via the control terminal and afterwards activated at any time. Within practical limits, this personal profile can be assembled to suit individual tastes from a wealth of possible settings. With this development too, the engineering team complied with the basic principle of simple, intuitive operation. Audi is convinced that the vast majority of drivers would find it confusing and unnecessary to have to choose from hundreds of different parameters.

The central element in electronic shock absorber control is the new high-performance control unit. It has the imposing data spread of 32 bits and operates at high speed. The computer analyses the signals from 14 sensors continuously, and calculates the current for the electrically controlled shock absorbers at each individual wheel a thousand times a second.

Continuous control: the CDC shock absorbers

The CDC (continuous damping control) shock absorbers, similar to those that Audi already uses on the luxury Q7 SUV with air suspension, are twin-tube gas-filled hydraulic units with an additional external valve and connecting pipe. Their operation can be continuously varied: an electromagnetically energised proportional-action valve opens against the force exerted by a spring and regulates the flow of hydraulic fluid between the inner and outer shock-absorber tubes.

A smaller flow cross-section makes the damping characteristic firmer, a larger one makes it softer.

Within the mode that the driver has chosen at Audi drive select, the control unit employs adaptive characteristics. It modifies its command signals to match the driving style and road conditions. Even from the 'comfort' mode the shock absorbers can be switched in an instant to a firm setting if required, though not to the absolute limit. They are installed in conjunction with sports suspension springs, which have the effect of lowering the body by 20 mm, but still provide a good standard of ride comfort – on poor roads, as good as the standard suspension.

The control unit selects the optimal damping force for the actual driving situation, for instance firmer damping to prevent body roll when cornering fast or braking, lower damping force if the surface under the wheels is extremely rough or average settings on poor-surfaced country roads.

Tested in space: Audi dynamic steering

Sporty driving pleasure and a high standard of safety have been two typical Audi core values for a long time on all its cars. The dynamic steering system, now premiered in the new A4, is a new departure for the Audi brand. A superimposed zero-play transmission, of a type already used successfully on astronauts' vehicles, varies the effective steering ratio according to road speed. The dynamic steering system moves sporty, safe driving up into a new dimension: together with the ESP electronic stabilisation system, it keeps the new A4 stable by means of slight, extremely rapid steering movements.

The superimposed transmission is located in the steering column and combined with an electric motor. It is of the 'Harmonic Drive' type that has already proved highly successful in robotics and space travel. In 1971, a transmission of this type voyaged into space for the first time on board Apollo 15: it was part of the individual wheel drive for the 'Lunar Rover' car used on the surface of the moon. In 1997, Mars was its next destination, on the 'Sojourner' expedition vehicle used during the spectacular 'Pathfinder' mission. This type of transmission is also operating on the Hubble space telescope, which was launched in 1990.

Proven in space, the strengths of the harmonic drive principle are applicable in all important areas of automotive technology as well. The transmission is extremely compact, light in weight and resistant to torsional stresses; it operates without play and is therefore extremely precise, with low friction. It can transmit immense amounts of torque and achieve high efficiency levels. Audi is the first automobile manufacture in the world to make use of this brilliantly conceived device, the features of which taken as a whole are far superior to anything that competitors have to offer.

Ingenious design: only three main components are needed

The harmonic drive transmission has the simplicity of genius: it has only three main operating components. An electric motor turns an elliptical inner rotor which, by way of a ball bearing, alters the shape of a thin sunwheel connected to the steering input shaft. At the vertical axes of the ellipse, the sunwheel meshes with the teeth on the inside of an annulus or ring gear, which acts on the steering output shaft. When the inner rotor is turned, the main axis of the ellipse changes, and with it the extent of gear tooth meshing. Since the sunwheel has fewer teeth than the annulus, there is relative movement between them – the superimposed movement used to alter the effective steering ratio.

The specific demands of the dynamic steering system have led to the appropriate optimisation of the components that form part of the system. The power steering pump supplies a larger

volume of oil if necessary, and the servotronic operating characteristics have been revised. The control unit is an extremely robust unit, secure against outside interference. The dynamic steering system is available for all versions of the new A4 from 140 kW upwards that do not already have servotronic as standard equipment.

Wide operating range: the ratio can be doubled

The dynamic steering ratio can vary by almost 100 percent, depending on the car's road speed and the chosen Audi drive select mode. Changes in the ratio take place continuously and are unnoticed by the driver: here too the Audi system demonstrates its superiority over its competitors.

When parking the car, the dynamic steering system is extremely direct, with only two turns of the steering wheel from lock to lock, and very little effort needed thanks to a high degree of power assistance. At typical country-road speeds, the direct response and level of power assistance are reduced slightly, but even then the driver will not have to move his or her hands to another point on the steering wheel when negotiating a sharp corner. At high speeds on motorways or similar roads, a more indirect steering ratio and less power assistance ensure that the car can be driven in a relaxed, confident manner and has a high degree of straight-line stability; in theory, four turns of the wheel from one steering lock to the other would be necessary.

The dynamic steering system cooperates closely with ESP in the vehicle dynamics and safety areas. It relieves the burden on the electronic stabilisation program for the simple reason that a steering correction can be performed about three times faster than the time needed to build up pressure for a brake application. This ability to intervene so rapidly makes many a brake application superfluous, and the journey proceeds more dynamically and smoothly. Although the steering corrections are highly effective, the driver remains unaware of them in most cases, especially since no noise is generated.

Corrective action by dynamic steering

A 'classic' critical situation is caused by oversteer following a sudden load reversal. The rear end of the car may for instance slide outwards if the driver is obliged to change direction in order to avoid a collision. If the car's angle of float is small to moderate, the dynamic steering system can rectify the situation alone, by turning the steering in the opposite direction. A brake application will not be made unless the angle of float becomes too great, and in most cases is only needed to suppress residual movement.

The dynamic steering system also lends a helping hand in the event of understeer; that is to say if the car tends to run wide on a corner. The steering ratio is made more indirect for a short time, so that the driver is unlikely to turn the wheel beyond the limit of good tyre grip. The steering angle remains small and easily controlled, and understeer is almost completely suppressed. This function is exclusive to the new Audi A4 and not available from its competitors.

Braking on surfaces with different friction coefficients under the left and right wheels, also referred to as μ -split braking, can give rise to situations that are difficult for the car to master. The side of the car with the better tyre grip and braking force pulls the car away from the chosen line. The dynamic steering on the new A4 can cope with this problem almost unassisted: the driver simply turns the wheel in the direction he or she wishes the car to take, and can then concentrate on more important matters. If a μ -split situation arises, the system takes action even if ESP is switched off.

No compromises: the wheel brakes

Audi would not be living up to its reputation unless it supplied a brake system of no-compromise high performance for the new A4, the sportiest car in the midsize market segment. The wheel brakes for the new Audi A4 are an entirely new development and larger than those used on the previous model by a whole order of magnitude. Even cars with a four-cylinder engine (1.8 TFSI and 2.0 TDI) have a 16-inch system at the front (with discs of 314 mm diameter) and rear (300 mm); the front brake discs are ventilated. V6-engined cars have composite aluminium brake callipers and larger (320 mm diameter) front discs.

Even on the standard brake system, the pad surface area has been increased by about 20 percent. The newly developed high-performance pads combine high, stable friction values with low susceptibility to fading even when called upon to sustain severe loads. The new brake discs also increase the system's retardation potential significantly. The ventilated discs have been modified in detail to improve heat dissipation; this is achieved by optimal friction surface contact and a new design principle that dispenses with the conventional cooling channels. The two halves of the disc are connected by hundreds of small metal cubes, between which a high volume of heated air can dissipate in a very short time.

The brake callipers for the more powerfully engined cars are also totally new: they use the floating-calliper principle and are of composite construction. Areas calling for maximum load resistance are made from high-strength spheroidal-graphite cast iron. The bolted-on piston housing is made of aluminium, and conducts heat away most effectively.

These brake callipers are light in weight but exceptionally rigid. The driver of the new A4 will experience this as firm, precise pedal movement and accurate feedback that enables the brakes to be controlled sensitively and with low pedal effort. The brake-servo operating characteristic has also been modified with this aim in mind.

Audi has achieved weight savings with the new type of brake disc (up to 2 kg per car) and by using aluminium cover plates (1 kg). Since this is unsprung weight, every reduction achieves a direct improvement in the car's sporty handling. Calliper and wheel design also have specific advantages for the customer: in the dealer's service reception area, for instance, the mechanics can measure brake pad thickness reliably with a simple tool; the wheels do not have to be removed.

New valves: ESP 8.1

ESP makes a considerable contribution to the agile, sporty impression that the new Audi A4 makes. This vehicle stabilisation system, supplied by specialist manufacturer Bosch, is now a new-generation version coded 8.1. It incorporates high-precision hydraulic valves of a new type that control pressure build-up with great accuracy, without unpleasant but all-too-frequent jerking or noticeable vibration.

The ESP operating concept is also new. As before, it can be switched off completely by holding the button pressed in, but a second, less complete shut-down stage is now provided as well. If the driver presses the ESP button once briefly at a speed below 70 km/h, the wheelslip control function will be de-activated. This largely prevents engine-management intervention and weakens the system's brake applications slightly.

If the dynamic steering option is ordered, the stabilising steering impulses remain active. A warning light comes on in the cockpit as a safety precaution.

For the A4 with front-wheel drive, the "ASR off" mode has useful benefits when snow chains are fitted: the wheels can be allowed to spin, which is frequently an advantage – without having to switch ESP off completely. The "ASR off" mode is effective at any road speed on the A4 with permanent four-wheel drive, whereas cars with front-wheel drive switch back automatically to the full ESP mode above 70 km/h.

Versatile: new ESP functions

ESP can do even more on the new Audi A4, for instance stabilise a trailer that starts to snake by applying the wheel brakes of the towing vehicle separately in a rhythm opposed to the

outfit's swinging movements. If a panic brake application at a rate of retardation exceeding 0.7 g is made, it switches on the hazard warning flashers automatically. In wet weather, it clears the water film off the brake discs by applying the brakes briefly at intervals to an extent that remains unnoticed by the car's occupants. If braking loads are very high, for instance when an enthusiastic driver is descending a mountain pass, it compensates for the fading effect caused by heat build-up that can occur if a full brake application has to be made.

During development of the new Audi A4, there was close cooperation between the engineers responsible for ABS and their colleagues at the tyre manufacturers who supply their products as initial equipment. Their work was closely coordinated and yielded a suitably modified ABS strategy, as a result of which the new A4 can make full use of the high friction ratings of its tyres when the brakes are applied.

Visual distinction: the choice of wheels

The range of wheels also emphasises the character of the new Audi A4. The various patterns of wheel, with sizes from 16 to 18 inches available, create a strong visual impression, and their large diameters of 660 mm or more fill the wheel arches in an imposing way. Audi is launching the new A4 with four patterns of elegant, high-quality wheel to choose between.

As a standard fit, the 1.8 TFSI and 2.0 TDI are shod with 16-inch alloys wheels and 225/55 R 16 tyres. The 2.7 TDI wears 17-inch alloys with 225/50 tyres and the 3.2 FSI quattro boasts 18-inch alloy wheels with 245/40 tyres.

More precise measurements: the tyre pressure monitoring display

The innovative second-generation tyre pressure monitoring display that Audi installs on the new A4 is both an intelligent and reliable option. It detects rapid loss of air from the tyre in the same way as a conventional indirect-measuring system, but unlike such systems also indicates which wheel is affected.

The tyre pressure monitoring display also detects situations – caused by diffusion – in which all four tyres lose their pressure very gradually. This may not amount to more than 0.1 bar per month, but if disregarded can lead to severe damage. The system does not only guard against this situation in the conventional way by comparing the four road wheels' speeds of rotation, but also registers the torsional vibration generated by the road surface. If there is a loss of pressure, the tyre's sidewall stiffness changes and with it its characteristic natural frequency.

Since the tyre pressure monitoring display is a software system integrated into the ESP, its readings are not falsified by external circumstances – a heavily laden boot, snow chains on the tyres or loose stone surfaces. It re-analyses the frequency patterns continuously and can identify disturbance factors. After correcting the tyre pressures, the driver has to recalibrate the system. Unlike direct pressure measuring devices, which use battery-powered sensors at the wheels, The tyre pressure monitoring display needs no routine maintenance or replacement parts throughout its life. Here too, Audi customers profit directly from ‘Vorsprung durch Technik’.

Driver assistance systems

Be more relaxed at the wheel, and reach your destination safely – the innovative assistance systems in the new Audi A4's specification keep you in control of every situation that can occur during your journey. Audi, motor of progress in this area too, can supply various convenient high-tech systems derived from luxury cars for its new saloon model. They keep the A4 at a safe distance from the vehicle in front, for example, warn the driver if the car tends to stray from its lane and make parking much easier.

Passive and active systems have significantly reduced the number of road accidents and their severity in recent decades. Audi remains at the forefront of this development. New types of assistance system can be realised with the aid of sensor technologies developed a few years ago for luxury saloon models such as the A8, and with today's high-speed control units. Their capabilities are almost human as they can for instance scan certain areas around the car and identify the decisions and actions that the driver should take.

A study conducted by German insurers indicates that 25 percent of all road accidents are due to lack of attention on the driver's part – fatigue, distraction or poor concentration. This is the problem area that Audi's systems are designed to defuse by making driving safer and more relaxed.

Although this rapid progress is fascinating in its way, Audi never forgets that technology is not an end in itself, but has to be developed to serve those who buy and use it. The aim must always be to relieve the driver's workload, without absolving him or her from ultimate responsibility, and certainly without insisting on a certain course of action.

Adaptive Cruise Control

Another assistance system that originally appeared on luxury-class cars is radar-aided control of the distance from the vehicle in front. The system used on the new Audi A4 is known as 'adaptive cruise control' (ACC). The driver preselects a suitable road speed between 30 and 200 km/h, and ACC keeps it constant for as long as the distance from the preceding vehicle permits; this can be up to 180 metres. The radar sensor detects when the car is approaching the vehicle ahead too closely.

If the driver decides to overtake, ACC is temporarily overridden by pressing the accelerator pedal down, but remains active and later restores the preselected road speed and the corresponding distance that the system maintains from the preceding vehicle. The system is

de-activated whenever the brake pedal is pressed, however, and then has to be reset at the control lever. This restores the previously chosen settings.

Doppler effect and signal transmission time: how ACC takes its measurements

The radar sensor is located at the right, next to the single-frame grille, in an exposed housing with a plastic lens. The scanning angle is about eight degrees, the range approximately 180 metres. The radar sensor's four transmitting/receiving units operate in the 76.5 GHz frequency range, which is licensed for radio signals. The transmitted signal is of the FMCW (frequency modulated continuous wave) type. The directly measured values are the differences in frequency between the transmitted and received radar signals. With the aid of the Doppler effect and the signal transmission/reception time, the speed of the vehicle in front and its distance from the car can be determined.

Comparison of the signals received at the four individual aerials also established the angle of the vehicle ahead in relation to the sensor's central axis. However, before the relevant preceding vehicle can be identified from the various objects that the sensor has registered, the lane on which the car is travelling must be known. This is computed from the ESP yaw-rate and steering angle sensor signals and from radar information on road and lane limits (e.g. crash barriers) and movements of other road users.

The system is integrated into the CAN network, which extends through the entire car; it can therefore communicate within a few thousandths of a second with other control units, such as those for engine management, the automatic transmission and the brakes.

Controls and displays

The driver selects his or her preferred speed according to the speedometre calibrations: between 30 and 80 km/h in five km/h steps, above this in ten km/h steps. The preselected speed is shown by LEDs on the speedometer dial. The system's status (on/off – vehicle identified) is also visible on the central display. The time interval between the car and the vehicle in front can be varied in four stages, from 1.0 to 2.3 seconds: the driver information system displays this graphically. There are also three settings for the dynamic character of the system: dynamic/standard/comfort. By accelerating or braking, the system adjusts the car's speed until it matches the program selected by the driver. The 'comfort' setting has a maximum retardation rate of 3 m/s^2 .

Lane monitoring as a collision warning – Audi braking guard

The ACC sensor also has an additional safety function. If there is a risk of colliding with the vehicle ahead, the system warns the driver in two successive steps. In the first, a gong signal is heard and a signal is displayed on the instrument panel. As a precaution, the ESP builds up a degree of pressure in the hydraulic system during this step, so that full braking performance is available if the driver reacts by applying the brakes.

If the driver does not react, a clearly noticeable warning follows: the system applies the brakes for a brief period. This only slows the car down slightly, but is sensed by the driver as a sudden jolt and is of course intended as a ‘wake-up’ reminder. By means of extensive testing, Audi has confirmed that this is a highly effective warning signal. If the driver now applies the brakes, full stopping power is available without delay, and even hesitant pressure on the pedal will cause the hydraulic brake assist to make a full brake application.

The braking guard remains on duty even if ACC is de-activated. However, either the early warning or the complete braking guard function can be switched off separately at the MMI.

Audi Side Assist

Audi side assist also makes use of intelligent radar technology. Designed specifically for lane changes, it warns the driver if a potentially hazardous situation is likely to arise. Two radar sensors in the rear bumper, operating at a frequency of 24 Gigahertz, scan the area next to and behind the new Audi A4, up to a distance of 50 metres from the car. A high-performance computer unit evaluates and interprets the signal data.

If another vehicle is moving at approximately the same speed in the critical zone, or is approaching rapidly from behind, a yellow LED display comes on in the left or right outside mirror housing. It is ‘subliminal’ in character: the driver only sees it when looking directly into the mirror, whereas it is not registered by the driver when looking forwards.

If the driver of the new A4 operates the flashing turn indicator in preparation for changing lanes, despite the illuminated warning signal, the intensity of the LEDs is increased and they flash for about a second at a higher frequency. This signal is very difficult to overlook, since the human eye is extremely sensitive to changes in contrast in the peripheral viewing area. Audi has analysed the viewing behaviour and the effect of the display in full detail in an extensive series of tests with drivers of various statures and ages.

The optics of the display on the inner face of the mirror housing has been carefully aligned so that it can be seen by the driver. The brightness of the display varies according to ambient light conditions, from a dark moonless night to the midday sun in southern climes; it can also be adjusted via the MMI control terminal. The system becomes active at a speed of 60 km/h and is therefore out of action in built-up areas; it can be switched off at a button near the exterior mirror.

Audi Lane Assist: lane changes without risk

Also available for the new Audi A4 is a third high-tech assistance system previously only found in luxury cars – Audi lane assist. Above a road speed of about 65 km/h, it warns the driver if the car is wandering to one side, out of the chosen lane. A small black-and-white camera mounted on the windscreen above the inside mirror observes the road ahead of the car. Its optics has a range of 60 metres and a viewing angle of about 40 degrees. A high-speed computer in the same housing identifies lane lines marked on the road surface and determines the car's position in relation to them.

If the driver allows the car to wander in the direction of a lane marking but has not indicated that he or she intends to make a turn, Audi lane assist issues a warning in the form of a vibration through the steering wheel. Its intensity can be selected in three stages at the MMI. There are also three settings for the moment at which the warning is initiated: before a wheel reaches the line, when the line is crossed or according to the system's own variable assessment of the situation.

Audi lane assist can be switched off if not required. A display on the instrument panel tells the driver when it is active but not capable of issuing a warning, possibly because the lane lines are not clearly marked or the car's speed is too low.

Acoustic Parking System: Parking made easy

To make parking easier, Audi has made three different parking assistance systems available for the new A4. The best known of these is the successful Audi parking system (APS), which supplies an audible signal as the rear of the car approaches an obstruction while reversing (optional for 4-cylinder models).

The second version, APS plus, (standard for V6 engines) has additional visual displays for the front and rear, with a total of eight ultrasonic sensors in the bumpers.

The high-tech solution is the Audi parking system advanced, (available with Navigation Plus and MMI) which has an integral rear-view camera. This is built into the boot lid and is extremely sensitive. Its 'fish-eye' lens has a very short focal length and can therefore provide a 130-degree wide-angle view behind the car. Its images are processed to eliminate distortion before being displayed on the monitor of the MMI operating system.

The display includes various guide lines and zones to help the driver position the car correctly when reversing. When reversing into a parking bay at a right angle to the direction of travel – the standard mode – orange lines indicate the path that the car should follow. To park the car by reversing into a bay parallel with the road, an area shaded in blue indicates the space that the Audi A4 will occupy, so that the driver can see whether the parking manoeuvre will be successful. Blue lines indicate when to turn the steering one way and then the other.

The camera also shows the trailer tow hitch that can be installed as an optional extra. With the aid of this image, the Audi A4 can be reversed accurately up to the trailer towbar. In addition to this real-image mode, APS advanced also provides the classic visual and audible parking aids using signals from ultrasonic sensors. The driver can use the MMI controls to switch between the video-camera image, a graphic display or automatic changeover between the two.

Multimedia systems

The Audi A4 sets new standards in the midsize segment – and the area of multimedia, one of the most exciting technical fields of the future, is no exception. The new saloon model is being launched with an attractive package of communication and entertainment technologies, the components of which can be matched as required to individual needs and preferences. The items include various audio systems, TV reception, two navigation systems, an iPod interface and an extremely convenient Bluetooth mobile phone link.

The Audi A4 is supplied with a high-performance audio system as standard equipment in the form of the Concert radio (4-cylinder engines), which has a 6.5-inch colour display screen. The Concert controls are in accordance with Audi's much praised MMI logic, and use a rotary pushbutton and large switches ideally positioned for intuitive operation. The Symphony system (6-cylinder engines) is the next step up with a 6-stack CD player.

An optional lifestyle feature for the concert and symphony radios looks well ahead into the future of portable music and is standard when ordering MMI and Navigation Plus. The Audi music interface (AMI) makes it easy to carry a library of music, often stored in an iPod, to be used everywhere – including in the car.

The AMI interface is capable of linking to the customer's iPod and allowing all its controls to be used. The radio display then displays the player's menu structure with all its replay lists and additional information; operation is from the radio or the multifunctional steering wheel, another optional extra.

The AMI links with a fourth-generation iPod; by means of a separate adapter cable, any other audio player with a USB 2.0 interface can also be connected. Its data will then be played via the car's audio system, though no control facility is available in this case. Audi has designed the AMI software as modular elements – individual drivers are included in the memory for communication with the players and to enable their protocols to be read. If a new player comes on to the market, its driver can be installed quickly and easily as an update.

Double tuner: two aeriels, two receivers

The concert and symphony radios contain a double tuner: a digital processor takes its signals from two aeriels after pre-processing by the two tuners. One of the tuners plays the music, so to speak, while the other searches in a regular cycle through all the available stations in the background, in case a better signal can be received. This technology suppresses what is known as multipath interference, as caused for instance by signal reflections from buildings or

in the mountains. It calls even weak stations down from the ether, since the two reception paths can be combined in such a way that the two aerials perform a direction-finding function.

Quite apart from the AMI interface and the double tuner, both Audi radios are genuine all-rounders. They have an SD card reader (SDM = Secure Digital Memory) for audio files and a CD drive; both of these can also play music in the mp3 and wma formats.

A six-disc CD changer is integrated into the symphony radio. As with the chorus radio, the 4 x 20 watt amplifier supplies four channels and eight speakers. The extended CAR menu control facilities are a further welcome feature.

A highlight in the midsize class is the option of digital audio broadcasting (DAB) on the concert and symphony radios and on the navigation systems. Digital VHF signals are superior to the analogue standard in their dynamic range, clarity and spatial quality. DAB is in widespread use in many European countries, with almost complete coverage in Germany, Great Britain and Belgium. Audi DAB tuners compute the stereo signal by way of a signal processor, and prepare additional radio-text data in parallel.

MMI: navigation system and highly convenient operation

The next two even more complete equipment levels include a navigation system. In this case system control is carried out entirely at the MMI control terminal. As in the A8 luxury saloon, this is on the centre tunnel in front of the gear lever or tiptronic automatic transmission selector. Behind the control panel, the components are networked by an extremely high-speed optical conductor, with a special gateway functioning as the interface with the other control units in the car.

The full MMI version (navigation system with DVD) which is optional on all A4 models is equipped with AMI as standard, a double tuner and a seven-inch colour display as well as the CD changer. It obtains its navigation data from a fast, high-performance DVD drive. Speech control and a TV tuner are options for the high-end system.

Digital channels (DVB-T) can also be picked up; for safety reasons the screen displays them only when the car is stationary, but the soundtrack can be heard all the time. MMI basic plus and the navigation system with DVD are coupled with the ex-factory four-channel speaker system.

Based on the concert and symphony radios, Audi supplies two high-class sound systems. The standard Audi sound system has a 180 watt rating and supplies an impressive, harmonious audio image to its ten speakers. As well as the usual eight speakers, there is a centre speaker in the dash panel and a 260 mm sub-woofer of 75 watt rating in the rear shelf. This system has provision for numerous alternative settings to be chosen.

State of the art: the Bang & Olufsen sound system

Leading the way in technical and acoustical quality is the sound system from Bang & Olufsen. Derived from the one used in the A8 luxury saloon, it is no less of a delight to the ear in the new Audi A4. With its sparkling, brilliant reproduction, detailed resolution, precise spatial imaging and broad, well-defined frequency spectrum, this product from the Danish sound specialists satisfies every wish with its high precision and quality.

Audi and Bang & Olufsen – a cooperation between two partners with the same objectives. Both brands attach great importance to leading-edge technology, intuitive control and distinguished technically led design. To these must be added a no-compromise attitude to materials and workmanship, and in-depth competence in working with aluminium, a material that Bang & Olufsen uses for the speaker covers.

The key element in the Bang & Olufsen sound system for the new A4 is an amplifier with a supreme 505 watt output rating. It processes signals digitally according to the manufacturer's own surround algorithm, which enables the occupant of every seat to enjoy the full splendour of the system's audio quality. The numerous user settings include four sound emphasis points: the system analyses the noise level inside the A4 by way of a special microphone and makes selective frequency adjustments to its output signals.

The Bang & Olufsen sound system has ten active channels and 14 speakers. Two three-way systems are active at the front, each with speakers in the door, the triangular mirror mounting and the dash panel. At the rear there are two speakers in each door.

The acoustic choreography is rounded off by a centre unit in the dash panel, a 260 mm sub-woofer and two surround speakers on the rear window shelf. In accordance with typical Bang & Olufsen and Audi principles, this sound system was not merely dreamed up by the design engineers as a collection of bits and cycles per seconds, but has undergone repeated large-scale subjective comparisons with more than 50 people from various age-groups taking part.

Bluetooth: perfect telephone integration

Convenient, trouble-free use of the telephone has never been more important than it is today. Bluetooth mobile phone preparation (standard on V6 models) integrates the telephone into the radio controls and also has speech control combining the advantages of hands-free operation with the strengths of the classic built-in car phone.

For use with Bluetooth, the driver's mobile phone must support the SIM Access Profile; many of the current generation of mobile phones do this. The mobile phone is merely logged into the A4 system, which is able to carry out all its functions automatically when the driver inserts the ignition key. The mobile phone can remain in the user's jacket pocket; the phone in the A4 takes over all the data from the SIM card via the Bluetooth wireless link, and also the internal memory up to 1255 entries. The mobile phone is then switched off, which avoids unnecessary GSM radiation and prevents the battery from running down.

For optimal reception quality, the Audi Bluetooth car phone uses the A4's own aerial. It can be operated most conveniently by speech input, at the MMI controls or from the optional multifunctional steering wheel. To ensure excellent hands-free quality, an ultra-modern digital speech processor suppresses echo and road noise. Speech output is via the sound system, using the radio's volume control.

Equipment

Premium means the finest in style – the new Audi A4 displays its noble character in its equipment too. All A4 versions have a very complete specification, including leather upholstery, automatic air conditioning, daytime running lights, a light and rain sensor, leather multifunction steering wheel and an automatic boot lid release, but a wealth of luxury extras is available to enhance the new saloon model still further.

The complete Australian specification and options, including pricing, is available in the separate Specification Sheet supplied.

For the enthusiastic driver: S line

Customers with a dynamic approach to life and to driving their cars will certainly be interested in the extra-sporty S line, which will be introduced from July 2008. The choice covers an exterior package, which concentrates on small but visually effective highlights, and a sport package.

This comprises many attractive features, including numerous modifications inside the car, sports suspension with firmer settings, 18- or 19-inch alloy wheels and two exclusive body colours, Misano Red and Monza Silver. The products available from quattro GmbH include exclusive types of leather, a wood-trimmed and leather covered steering wheel and Rear Seat Entertainment.

Options

For those who plan to drive the new A4 in a particularly sporty way, there is a wide range of individual options. As well as two types of sports suspension, they include various Audi drive select modules incorporating dynamic steering and damping control. The selection of alloy wheels covers diameters from 16 to 18 inches. Safety in the event of tyre problem is enhanced by the temporary spare wheel and the tyre pressure monitoring system.

Customers with an active lifestyle will be interested in the luggage compartment and storage packages, the 230 Volt power socket, the folding rear-seat backs and the load-through hatch with ski bag. Audi can also supply a detachable trailer tow hitch, and in the lighting area there are xenon plus headlights (standard for 3.2) and the adaptive light cornering system as further options.

All options for Australian vehicles are contained on the separate Specification Sheet.