Automotive Technology in Bavaria +e-Car

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Audi – the leading brand in lighting technology

- *Audi further extends its lead in lighting technology*
- *Close cooperation between engineers and designers*
- *Innovative matrix LED headlights make their debut in 2013*

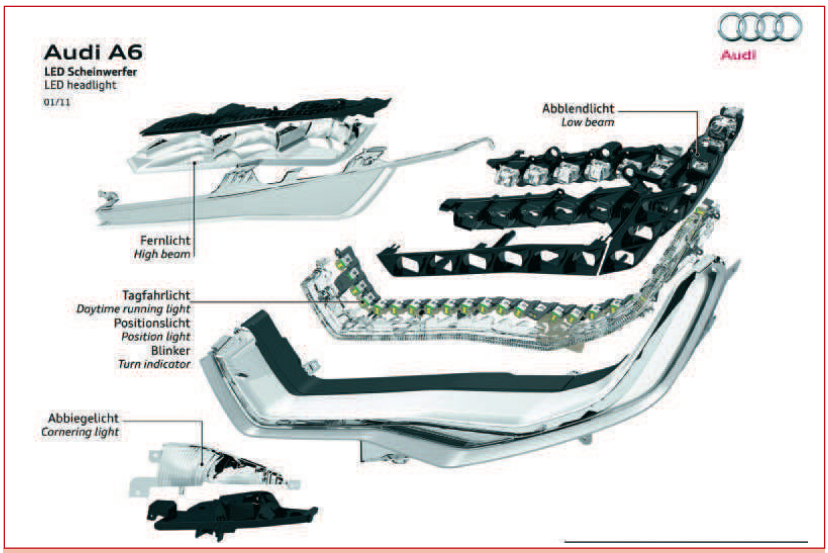
In lighting technology, Audi is driving progress at high tempo. Today, its xenon plus-and LED headlights already provide excellent illumination of the road and give the cars with the four rings an unmistakable look. In the future, vehicle lighting from Audi will react even more precisely to environmental conditions, and it will feature full electronic control. The first step in this direction will be taken this year in the form of innovative matrix LED headlights.

Function and Design – LED-daytime running lights and LED-taillights

Daytime running lights that consist of white light-emitting diodes are a safety and design feature that reflects Audi's frontrunner role among the competition. They made their debut in the Audi A8 W12 in 2004.

This was the first step towards giving an Audi a unique and unmistakable headlight design. Meanwhile, the LED daytime running lights are now offered in all of the brand's model series. In each model, the light-intense diodes offer many new degrees of freedom in designing the inner life of the headlight. Whether its lines are curved or straight, a model series from Audi is unmistakably linked to a specific type of lighting.

In the A1, two light-emitting diodes are used per unit; they emit their light into a transparent polymer tube, the light guide, which generates a uniform contour. In the Audi A7 Sportback, the daytime running lights of the optional LED headlights also appear linear, but they originate from 18 individual LEDs with a polymer body in front of them. The LED daytime running lights consume fewer watts of power, have extremely long life and are maintenance-free.



Audi A6: LED headlight ■

The introduction of full-LED headlights to the A6, A7 Sportback, A8 and most recently to the A3 model series , gives the cars unmistakable styling and a resolute look. The small LEDs can be arranged in lines, and they various lighting functions can be implemented by individually controlling the diodes. The headlights generate a light pattern that is unmistakable and in many cases achieves three-dimensional effects. Such impressive design features could only be realized by close cooperation between engineers and designers. Stephan Berlitz, Head of Development for Lighting Functions/Innovations at Audi, says: „We always find a way to perfectly harmonize technology and styling." Cesar Muntada Roura of Audi Exterior Design explains: „It is our understanding of one another's areas of competence that make us so strong." ■

Lighting technologies of today

Whether xenon plus or LED – the headlights and taillights in Audi models make a strong statement. The brand's lighting technologies combine their attractive effects with a high level of active safety – with adaptive light, today's headlights already react to the environment and to other vehicles in traffic. ■

Audi A6 Avant ■

Xenon plus-headlights

Xenon plus headlights are offered in all models of the Audi lineup, either as optional or standard equipment. Xenon headlights are gas discharge lamps. Two tungsten electrodes are fused in a quartz glass cylinder, known as the burner, and a concentrated light arc burns between. The xenon inert gas charge in the burner, which is pressurized up to 100 bar, gives off a slightly violet light, while metallic salts in the glass cylinder charge reduce its color temperature to the spectrum of daylight.

Xenon headlights provide a much brighter light and better illumination than halogen headlights with incandescent bulbs, their energy consumption is about

20 percent lower and they have much longer life. In xenon plus technology from Audi, a single burner generates both the low and high beam lights, and they are switched by a moveable shutter. Of course, all xenon headlights are mercury-free. ■

LED headlights

Audi is also far ahead of the competition in the area of LED headlights. This high-end technology was introduced in the R8 in 2008, and today it is being implemented all the way to the A3 model series. With a color temperature of around 5,500 Kelvin, the LED light resembles daylight, and this reduces eye fatigue. The light-emitting diodes are maintenance-free, designed to last the life of the vehicle, and are highly efficient. The low-beam light, for example, only consumes around 40 watts, which is five percent less than xenon plus units.

In the new A3, nine high-performance LED chips in two free-form reflectors generate the low-beam light, while the high beam uses ten high-performance LEDs to emit light through an aluminum trim aperture. The static turning and all-weather lights are housed in a separate module; while the daytime running lights, parking and flasher lights are formed by a light guide that wraps around the upper and inner headlights as a narrow contour. The „wing" gives structure to the interior of the headlights.

LED headlights from Audi have not only proved themselves on the streets, but also in car racing. They made their debut in the R 15 TDI Le Mans sport protoype in 2010. In 2011, full-LED headlights were installed for the first time in the next generation race car, the R18 TDI.

With their combined lighting power of over 200 watts, the LEDs generate a light pattern with a range of over one kilometer. Their equivalent luminous intensity of over 1,000 lux is five to seven times greater than headlights in produc-

Design model OLED 3-D rear lights ■

Audi R8: Indicator with dynamic display ■

tion cars. For many years now, LED technology has also been utilized in taillights – as standard or optional equipment. Unlike incandescent light sources, the light-emitting diodes reach full luminous intensity at lightning speed and without delay – when the driver brakes quickly, for example, the quick reacting brake lights give the driver of the vehicle behind additional valuable fractions of a second in reaction time. ■

adaptive light

Various adaptive light versions are available for the headlight systems. An electronic control module controls the swiveling xenon plus modules, or the LEDs, so that they always deliver the best possible lighting for city, highway and freeway driving. The driver can configure its mode of operation in the Audi drive select vehicle dynamics system.

One special component of adaptive light is smoothed dynamic headlight leveling. A video camera is used to detect vehicles ahead and oncoming vehicles; then the control module adapts the car's lighting to the distance to the other vehicles – via a soft transition that always maximizes the amount of illumination.

The all-weather light illuminates the area in front of the car significantly better than with fog lights. Depending on the specific system installed, this function might be implemented by activating the static turning lights in addition to other lights, which improves lateral illumination considerably. In addition, the xenon units (with xenon plus headlights) may be swiveled downward, and the LEDs (on LED headlights) that are responsible for the low-beam light might be switched off or dimmed. The interplay of these actions substantially reduces „self-glare" to the driver.

In the A6, A7 Sportback and A8 model series, an additional function is activated as soon as the optional night vision assistant detects a pedestrian. The system flashes three light pulses to the pedestrian with the high-beam light according to the specific situation. This clearly highlights the person and surroundings and warns the pedestrian. The system detects any oncoming traffic to avoid any potentially hazardous glare. ■

Use of route data

Networking of the headlight control module with the MMI Navigation plus system represents a unique selling proposition of Audi. The navigation system's route data enables such functions as early activation of higher freeway lighting range as the car is about to enter the freeway.

Route data is also used in the city. Close networking lets the lighting systems implement prepared solutions as needed. On city streets, a wider angle of the light pattern better illuminates the areas to the left and right in front of the car. In addition, whether within or outside city limits, the system activates the intersection light immediately before reaching an intersection, which makes it easier for the driver to look down cross streets. When turning, the cornering light is activated, which illuminates the curve better - either in the city or on highways.

Audi S3 ■

Lighting technology - Animated rear light
Lighting technology - Animated daytime running light ■

Another benefit is that in countries like England the headlights are automatically switched over to left-hand traffic. ■

Turn signal flashers with dynamized display

In updating its high-performance sports car, the R8, Audi introduced another innovation to production cars – a turn signal with dynamized display. It sends clearer signals to the environment than conventional turn signals.

This technology from Audi – which is used in the taillights – makes the turn indicators smarter. When e.g. operated as turn signal flashers, their light always runs towards the side in the direction the driver wishes to turn. This function is implemented on each side by a band of 30 LEDs with seven segments that are sequentially activated every 150 milliseconds. ■

The lighting technologies of tomorrow

Audi is already developing tomorrow's lighting technologies today, and four key trends are clearly discernible here: The Audi vehicle lighting will react even more precisely to conditions of the environment, it will communicate with it in a variety of ways and thereby further increase active safety.

Lighting of the future will feature full-electronic control and will be even more attractive and distinctive based on new dynamic functions. ■

Audi Matrix LED headlights

The technology of the future is known as Audi Matrix LED headlights – it subdivides the LED high-beam light into numerous individual segments. The individual light-emitting diodes, which work in tandem with lenses or reflectors in front of them, always deliver excellent illumination, without requiring a swiveling mechanism – instead they are separately activated, deactivated or dimmed according to the situation. This new technology gives Audi engineers and designers fascinating possibilities for configuring the number of LEDs, their arrangement and the size and design of the headlights.

The Audi Matrix LED headlights get the information they need from a camera, the navigation system and other sensors. When the camera detects other vehicles, this causes the high-beam light, which is subdivided into multiple sectors, to be blocked in a certain subarea. In complex situations, the headlights can also illuminate the spaces between several vehicles.

Based on navigation data, the high beam light predictively swivels into the curve even before the driver begins to turn the steering wheel. Essentially, the high beam light guides the driver along the road. This functionality is also reflected in the special headlight design. Illumination of the segments can also be experienced from outside. The matrix LED headlights will make their debut later this year. ■

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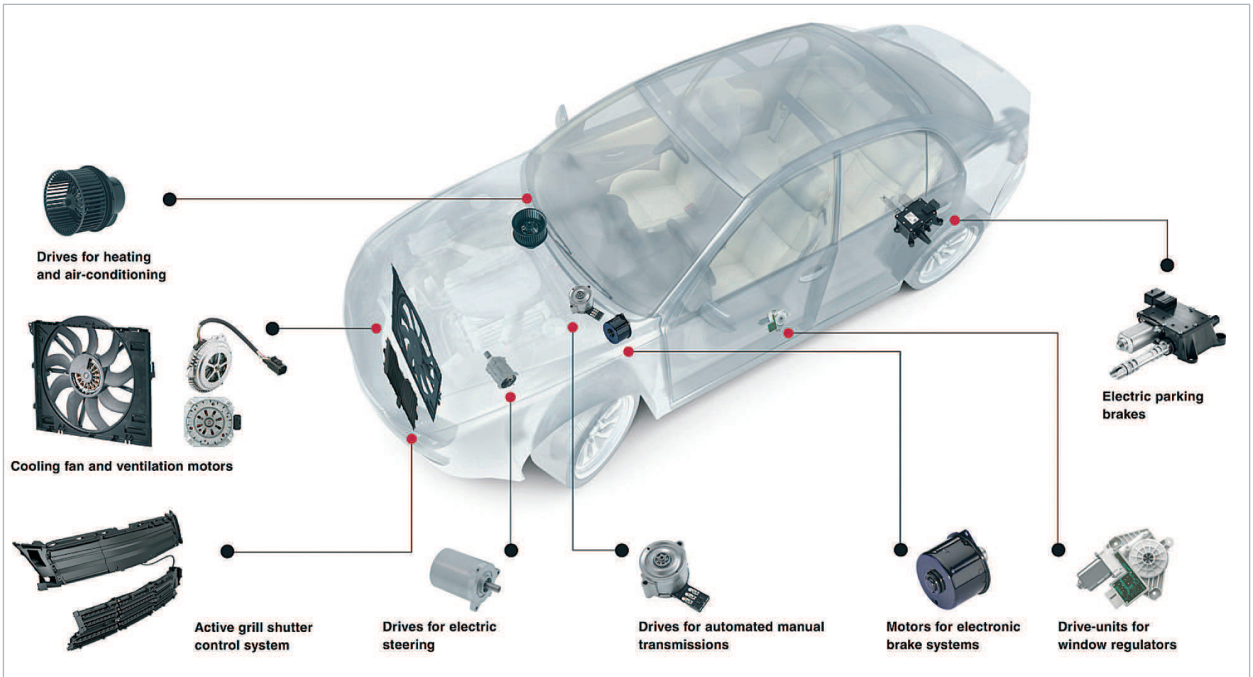
Power off until needed!

On-demand control of ancillary components for greater efficiency

The EU has set some ambitious targets for vehicle manufacturers: by 2015, Germany's new car fleet average will have to achieve a mandatory target of 130 grams CO_2 per kilometer. The federal government has raised the bar even higher by pledging to increase the number of electric vehicles on Germany's roads to 20 percent by 2020. At the same time, drivers are demanding ever greater levels of safety and comfort. This apparent contradiction calls for new, integrated approaches. Lightweight design and material substitution are essential, but not enough in themselves. Activation on-demand instead of wasteful continuous use is one way of conserving resources. This can be achieved by electrifying the ancillary components; an idea which is prompting developers in the drives division of automotive supplier Brose to introduce forward-looking solutions. For example, electro-mechanical steering with on-demand functionality increases efficiency and so reduces emissions by around 7 grams CO_2 per kilometer; drive train actuators with on-demand operation and optimized transmission reduce energy consumption and cut CO_2 emissions by up to 10 grams per kilometer. ■

As much as necessary and as little as possible: electro-mechanical steering

It's really very simple: power off until needed! And yet the majority of vehicle manufacturers leave



Series product range of Brose's drives division ■

Rack drive for electric steering – as used in the Audi A7 ■

their hydraulically driven ancillary components running during the entire time that the engine is running. Take power steering for example: although this is needed on average for only around 5 percent of the journey, hydraulic solutions where the combustion engine continuously drives the oil pump are still widely used. This means that energy is consumed throughout the journey time – even when the driver is not moving the steering wheel.

With electro-mechanical steering systems this is not the case, since power assistance is activated only as required. This has the effect of reducing fuel consumption by up to 0.5 liters per 100 kilometers and CO_2 emissions by around 7 grams per kilometer.

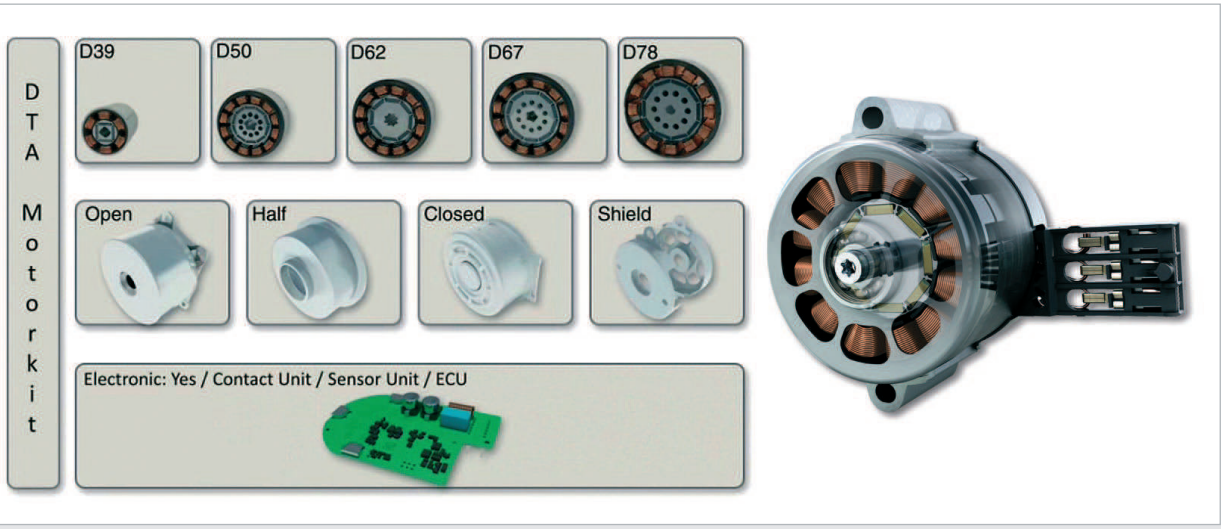
The operating principle: a sensor on the steering column detects the steering torque applied by the driver; this information is then transferred to the electronic control unit (ECU), which calculates how much steering assistance is required. The drive transmits the necessary steering torque via a ball screw to the steering rack, which then moves in the desired direction. This ensures that steering assistance is provided according to engine speed and steering maneuver. Greater driver comfort is also achieved: maximum power assistance is delivered when the vehicle is driving slowly, which makes parking easier, for example. When driving at speed, such as on the motorway, the electro-mechanical solution ensures safe and reliable maneuverability. The system also allows additional functions such as park assist or lane departure warning systems and driver steering recommendation to be integrated into the electronic stabilization program (ESP). ■

Motor expertise for all vehicle classes

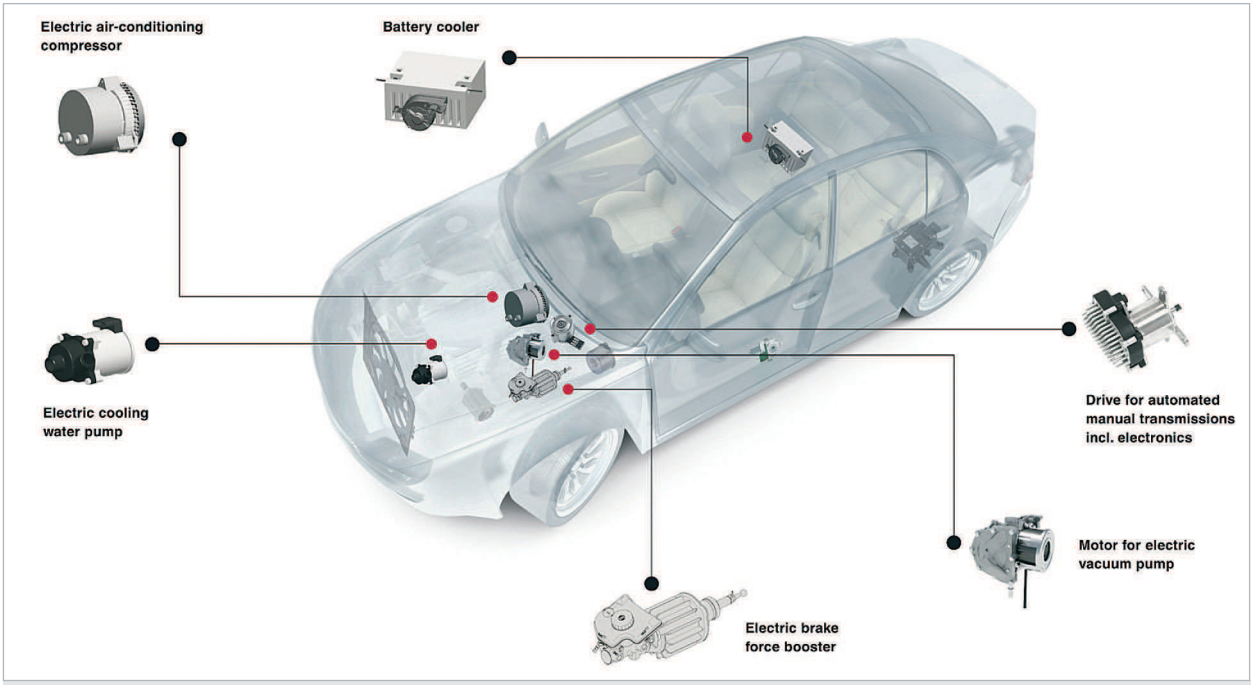
Brose supplies non-wearing, electronically commutated, permanent magnet excited synchronous motors for power steering drives in modular form (component assembly kits) which can be flange-mounted or built in. Torque ranges from 2.5 to 23 newton-meters with performance levels from 250 to 900 watt. Requiring very little adaptation, the drives can be used for cross-model applications in all vehicle classes: from column drive for small cars to pinion drive for the lower mid-range and rack drive for mid-range and luxury cars. All three drive versions are designed as electronically commutated inner rotors. At under 1.5 percent at maximum temperature, they have the smallest torque ripple on the market for optimum noise reduction. Efficiencies of around 80 percent are achievable with the aid of rare-earth magnets. The drives comply with specification at a temperature range of -40 to +125 °C and are short-circuit-proof and therefore fail-safe without the need for additional components. ■

Shifting at the right time every time: motors and drive train actuators

This system also features a small electric drive in the transmission which cuts fuel consumption and at the same time makes for a more agreeable driving experience: an electronically controlled gear change ensures a shifting point designed for optimized fuel consumption.



Modular system for drive train actuators: Motor size, housing design and electrical interface permit individualized combinations tailored to customer requirements ■



The Brose Group's electric motors division is exploring new ways of electrifying ancillary components ■

This makes it easier for the driver to operate the clutch and to select and engage the gear. The transfer case, automated transmission and locking differentials are also drive-assisted. With dual clutch transmission, this technology can save up to 10 grams CO_2 per kilometer. Brose is a world market leader in the design and manufacture of motors for drive train actuators (DTAs) with extensive experience acquired through series production of around 11 million units. It is continuously developing its systems to make them smaller and more efficient than other conventional components: virtually wear-free and configured as inner rotors, the synchronous motors achieve efficiencies of over 80 percent and speeds of up to 12,000 rpm depending on size. They cover a power range of up to 700 watt, depending on the model, and have been designed to ensure an operating life of more than 6000 hours. Electronic drive control generally allows operating points to be freely selected independently of characteristic curves.

A further advantage of this generation of motors is the high degree of standardization: five motor sizes ranging in diameter from 39 to 78 mm are available with a choice of four different housing designs. Four electrical interfaces (electronics, sensors, contact units and connectors) may be selected in combinations that meet specific customer requirements. The software included with the electronics is perfectly tailored to the drives because as a system supplier, Brose develops and manufactures the mechanical, electrical and electronic components in-house. ■

An integrated approach to optimizing energy consumption – for electric vehicles and vehicles with internal combustion engines

The electrification of ancillary components has only just begun: to equip vehicles for the challenges that lie ahead, designers at Brose are exploring other applications that may benefit from component electrification as a means of increasing efficiency; for example an electric coolant pump which can achieve fuel savings of around 2 percent. The mechatronics specialist also sees an opportunity to bring over 50 years' experience in electric motor design to the development of new systems for the electric mobility market. Still in the conceptual stage at present are battery cooling systems, A/C compressors and electric brake boosters. ■

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The Audi A3 Sportback e-tron

The A3 Sportback e-tron from Audi is a latest-generation plug-in-hybrid car. The premium compact vehicle will go on sale from 2014 and is a genuine Audi. It combines sporty power with impressive efficiency and abundant driving enjoyment with unrestricted everyday utility. The A3 Sportback e-tron offers 150 kW (204 hp) of system power and achieves average consumption of only 1.5 liters per 100 km (156.81 US mpg) of gasoline. In the electric mode its operating range is up to 50 kilometers (31.07 miles), with the TFSI engine adding a further 890 km (553.02 miles).

IFrom 0 to 100 km/h (62.14 mph) in 7.6 seconds and a top speed of 222 km/h (137.94 mph) – the Audi A3 Sportback e-tron adds an extra highlight to the sporty character of the compact premium car line. In accordance with the ECE standard for plug-in hybrid vehicles, its average CO_2 emissions are a mere 35 grams per km (56.33 g/mile) – equivalent to consumption of 1.5 liters of fuel per 100 km (156.81 US mpg).

Thanks to the ultra lightweight construction philosophy of Audi, the unladen five-door model complete with all electrical components weighs less than 1,580 kilograms (3,483.30 lb), with space for five occupants and plenty of cargo. It comes complete with all the brand's strengths – elegant design, sporty chassis, top-notch ergonomics, excellent build quality and an extensive choice of high-end assistance and infotainment systems.

The 1.4 TFSI combustion engine is one of the most modern power units of Audi. Inside the engine compartment, looking in the direction of travel, it is positioned a few centimeters further to the right than usual, to create space for the high-voltage components.

Audi A3 Sportback e-tron: A Plug-in-Hybrid with 150 kW system power ■

Its crankcase is made from diecast aluminum, weighing little more than 100 kg (220.46 lb).

The four-cylinder engine is state of the art in every respect – its low frictional losses, its turbocharger, its intercooler and its thermal management. One special feature is the way the exhaust manifold is integrated into the cylinder head. After a cold start, it brings the coolant swiftly up to operating temperature. At high loads the water jacket lowers the temperature of the exhaust gas.

Thanks to the high electric range of up to 50 kilometers (31.07 miles), many customers will only rarely experience the gasoline engine of the Audi

A3 Sportback e-tron in action. Another effect of the plug-in hybrid concept is that the TFSI is often only activated in kickdown situations, and is therefore subjected to high loads while still cold. For that reason, the developers have equipped it with a variety of protective features. These include modified cylinder liners and piston rings, plus a sensor to measure oil quality.

Developing 110 kW (150 hp) and 250 Nm (184.39 lb-ft), the 1.4

TFSI is a powerful unit. It supplies peak torque across the entire speed range from 1,750 through 4,000 rpm, thus harmonizing excellently with the electric motor. The maximum of 330 Nm (243.40 lb-ft) is available virtually from the off, and is maintained constantly across a broad speed range up to about 2,200 rpm. Its maximum output is 75 kW. The system output of the A3 Sportback e-tron is
150 kW (204 hp), and system torque is 350 Nm (258.15 lb-ft). With the combination of electric motor and combustion engine, an overall operating range of up to 940 kilometers (584.09 miles) is possible. And its road performance is unwaveringly sporty: It takes a mere 4.9 seconds to sprint from 0 to 60 km/h (37.28 mph).
The electric motor is a permanently excited synchronous machine. It weighs 34 kilograms (74.96 lb) and is liquid-cooled via a cooling jacket in the stator. The electric motor is located between the engine's dual-mass flywheel and the newly developed separating clutch, the K0 clutch. When the TFSI starts, it is tow-started by the electric motor via the clutch. As soon as the former has achieved the same speed as the electric motor, the clutch is opened. This smooth, highly precise process takes place within half a second.
Together with the K0 separating clutch, the electric motor is integrated into a newly designed six-speed e-S tronic, which transfers the power to the front wheels. Like all Audi dual-clutch transmissions, it consists of two subsidiary transmissions that are served by the two multi-plate clutches K1 and K2. Gears are shifted by switching the clutches. This takes just a few hundredths of a second and happens without any noticeable interruption in propulsive power. Depending on the level of charge, the voltage ranges between 280 and 390 volts. The battery consists of 96 prismatic cells arranged into eight modules of twelve cells each. Including the electronic components – the battery management controller and the battery junction box – the battery system weighs 125 kilograms (275.58 lb). Its housing is bolted to the vehicle floor at five points, and the lower shell is made from aluminum.
An elaborate liquid cooling system ensures that the battery is kept within a suitable temperature range during operation. Drivers of the Audi A3 e-tron will be able to start electrically in hot summer conditions and at sub-zero winter temperatures alike. Four cooling plates regulate the temperature of the high-voltage battery's eight modules. The cooling system represents a separate low-temperature circuit in the car and runs on a separate cooler housed in the engine compartment. If need be, it can be connected to the air conditioning system and even divided into two subsidiary circuits.
In the event of a crash sufficiently severe to trigger the belt tensioners or airbags, the entire system is disconnected from the power supply. The flat-shaped battery is installed under the rear bench seat – an area where the high-strength and ultra-high-strength steel components of the occupant cell form an especially strong structure. Its housing and interior structure are equally of a very sturdy design.
The 12-volt battery for the low-voltage consumers and the 40-liter (10.57 US gallons) fuel tank are located above the rear axle. Both components barely impinge on the trunk of the A3 Sportback e-tron – in the standard configuration it measures 280 liters (9.89 cubic ft) and 1,120 liters (39.55 cubic ft) with the rear seat backs down.
Audi supplies the A3 Sportback e-tron with a universal charging lead as standard. The customer can interchange the connecting plugs so that the lead can be used both with domestic power sockets and with industrial power sockets, for full charging performance. These connecting plugs are country-specific in design, so that the A3 Sportback e-tron can be recharged anywhere in the world.
For easy use at home, the charging lead can be clipped into a wall-mounted holder. Even this holder has an Audi design, and as well as being a convenient way to store and use the lead, it is lockable. The charging equipment is thus protected against theft even when kept outdoors. The charging lead supplies the car with

Audi A3 Sportback e-tron: Cockpit ■

alternating current from the grid via the charging connection, which is in the Singleframe grille behind the fold-out four rings. As well as a status LED, the unit includes two pushbuttons allowing the user to choose between timer-controlled charging and immediate charging. In the car, the alternating current fed in by the charger is converted into direct current for the battery.

From an industrial power socket, it takes slightly more than two hours to charge the battery fully. From a normal domestic power socket in Europe, the charging process takes about three hours and 45 minutes. Audi is working intensively on a joint project with a supplier of renewable power, because electric driving only makes ecological sense if such power is available.

Another medium-term project of Audi is automatic charging without physical contacts, referred to as Audi wireless charging. Here the charging process involves an alternating magnetic field between the stationary charging pad on the ground and the mobile charging pad in the car, similar to the principle used by an electric toothbrush.

The power electronics, located in the engine compartment, then convert the stored direct current into three-phase current for the electric motor. It has six high-performance transistors for this task. The power electronics, which include a DC/DC converter for connecting up the vehicle's 12-volt electrical system, are compact and light in weight. They have a total volume of 8 liters (0.28 cubic ft) and weigh 10 kilograms (22.05 lb). Together with the charger, it is incorporated into the same cooling circuit as the traction battery.

There are yet more special components for electric driving. The air conditioning compressor has an electric drive integrated into the high-voltage network. A thermoelectric heating element and a gasoline-powered auxiliary heater round off the interior heating system.

System output	150 kW (204 hp)
System torque	350 Nm (*258.15 lb-ft*)
Output, 1.4 TFSI	110 kW (150 hp)
Torque, 1.4 TFSI	250 Nm (*184.39 lb-ft*) from 1,750 to 4,000 rpm
Output, electric motor	Max. 75 kW
Torque, electric motor	Max. 330 Nm (*243.40 lb-ft*)
Battery capacity / voltage	8.8 kWh / 280 to 390 volts
0 – 100 km/h (*62.14 mph*):	7.6 s
Range in electric mode	up to 50 km (*31.07 miles*)
Overall operating range in NEDC cycle	up to 940 km (*584.09 miles*)
Consumption acc. to ECE standard	1.5 l/100 km (*156.81 US mpg*)
CO_2 emissions acc. to ECE standard	35 grams/km (*56.33 g/mile*)
Top speed	222 km/h (*137.94 mph*)
Length / width / height	4,310 / 1,785 / 1,424 mm (*14.14 / 5.86 / 4.67 ft*)
Wheelbase	2,630 mm (*8.63 ft*)
Unladen weight	1,574 kg (*3,470.98 lb*)

Audi A3 Sportback e-tron: the technical data ■

The hybrid management is configured to function in harmony with the electric motor. Up to medium loads the electric motor, now functioning as alternator, largely handles retardation. The energy that it recovers is fed into the traction battery. The wheel brakes only become active if the driver presses the pedal more forcefully.

Braking recuperation is just one of several operating statuses of the Audi A3 Sportback e-tron. The car is almost always started electrically, even at very low temperatures, in extremely hot conditions or when battery charge is very low. The electric motor's high torque enables the sporty compact car to accelerate away powerfully. It goes from 0 to 60 km/h (37.28 mph) in 4.9 seconds – with quiet but forceful propulsion.

In the electric mode the Audi A3 Sportback e-tron can travel at up to 130 km/h (80.78 mph) – it could go faster, but that would not be efficient. When traveling at a constant 100 km/h (62.14 mph), generally only the electric motor is active provided there is sufficient energy in the battery. As soon as the driver steps hard on the accelerator, for instance to overtake, and causes the pedal to go beyond a certain resistance point, it prompts the TFSI to cut in via the K0 separating clutch. In the boost mode the Audi A3 Sportback e-tron accelerates with all of 350 Nm torque (258.15 lb-ft).

When the driver releases the accelerator at high speed, the hybrid management enters the gliding mode. Now both drives are entirely deactivated and are no longer developing braking torque. When stepping off the accelerator at medium and low speeds, the system recovers energy through coasting recuperation; braking recuperation then becomes active when the brake pedal is pressed, except if a full brake application is needed.

The driver has several ways of actively managing the vehicle's response. They can choose from three programs using a button in the driving area and the e-S tronic selector lever. The EV characteristic map gives priority to electric drive, whereas the Audi A3 Sportback e-tron behaves very sportily in the S program. The

hybrid hold mode can be selected via a menu in the MMI. This mode preserves the electrical energy stored in the battery for later use. In addition, the driver can specify detailed settings in the Audi drive select control system. Different stages of coasting recuperation are permanently assigned to the individual Audi drive select modes. Within certain ranges, this enables the driver to influence how the battery is charged while on the move.

The Audi A3 Sportback e-tron displays supply precise information about the driveline status. The powermeter in the instrument cluster shows the system's overall output, as well as the status of the driveline and the battery charge. The monitor for the MMI navigation plus shows the energy flows in the hybrid system. In addition, the driver information system displays the operating ranges and consumption figures for electricity and gasoline.

Under the Audi connect umbrella Audi is currently developing an entire portfolio of innovative online services for the A3 Sportback e-tron. Drivers can use these to monitor and manage a wide range of functions via their iOS or android smartphone or via a web portal.

The driver can call up the car's status – such as the battery's momentary charge status, the electric range or its current parked location. They can program charging schemes remotely from their mobile phone or computer. They have the option of starting and stopping charging or setting the charging timer and climate control scheme to reflect when they next plan to drive the car. They can thus specify in detail at what time on what days they want to drive off with the battery fully charged.

The climate control planner, the third aspect, works similarly. The owner of an Audi A3 Sportback e-tron can for instance specify a target temperature for the interior according to a differentiated timetable. Adjusting the climate in advance while still hooked to the power socket is much more efficient than when driving electrically, because it does not then constitute a drain on the car battery and thus optimizes the electric range. In addition, it also adjusts the drive components to the appropriate temperature for the conditions. Finally, the web portal gives the owner the chance to check their trip data, e.g. power consumption, distance driven and speed. ■

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- Performance testing and evaluation (e. g. LV 123, LV 124)
- Mathematical modeling for simulation Li-ion batteries in electric vehicles
- Support for achievement of directives, national & international standards and customized requirements for electric vehicle and components ■

Intertek certification marks – providing global market access ■

Industry specific expertise

Our experts are supporting industries like electric vehicles (batteries, electric vehicle supply equipment), automotive (EMC, environmental testing, safety, materials, engines, lighting, wireless), renewable energy (solar, wind), lighting, gas, semi-conductor, home appliances, HVAC, life, safety and security, HiFi/Video, IT & Telcom, industry, medical devices and building products. ■

Comprehensive service portfolio

Benefit of comprehensive services in testing, certification and inspection, like electrical safety testing, EMC testing, performance, product safety and environmental, chemical analysis, F & D support, accelerated stress testing, energy efficiency testing, ErP, failure analysis, sanitation testing, acoustic testing, efficient certification for the global markets. ■

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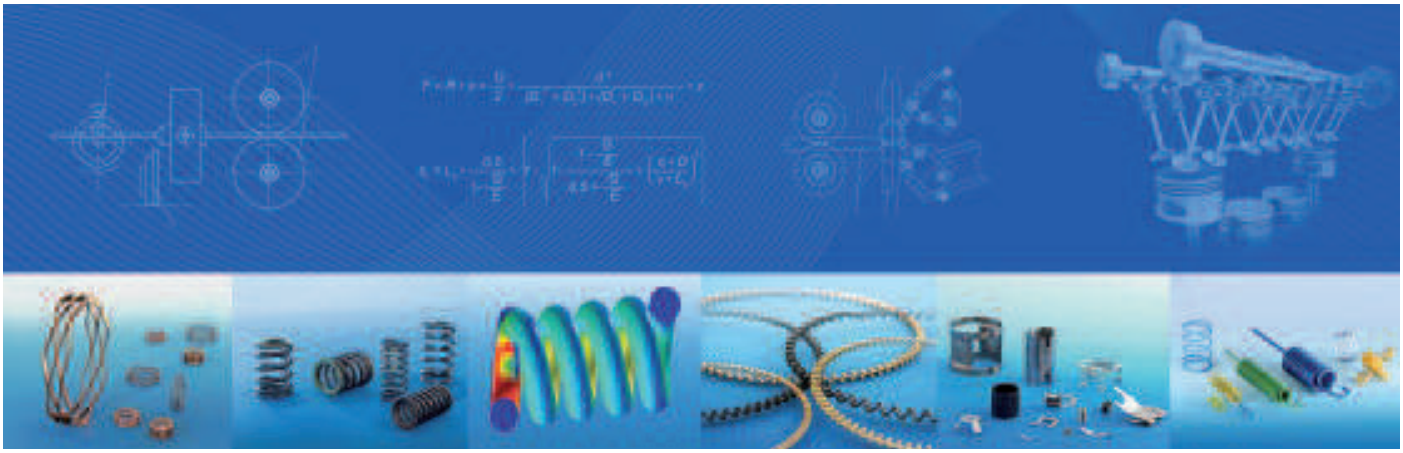


Challenge for the future – innovative solutions

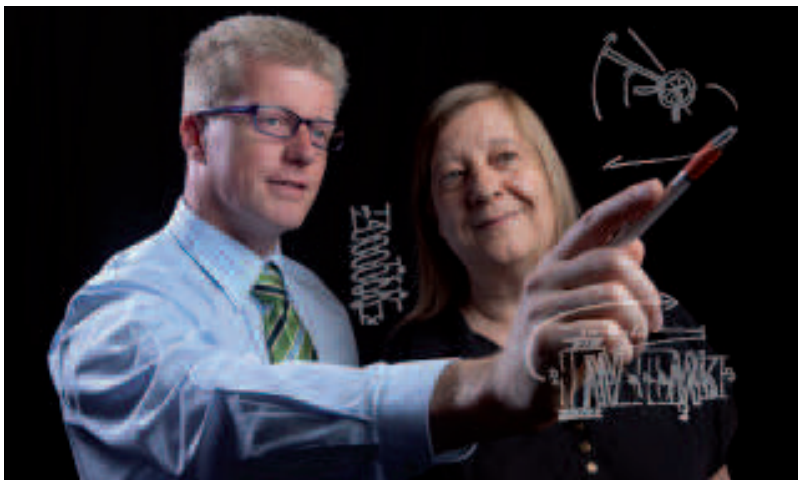
For more than 120 years, SCHERDEL has been setting the standards in metal forming of wire and strip material. In the meantime the family-owned Company founded in Marktredwitz has become a global player. The medium-sized Group of Companies is still directed by its owners and has 29 locations world-wide.

According to the slogan “Progress based on tradition – growth by innovation” developed by the Group Managing Director Walter Bach the range of services has also been extended. Besides the forming and assembly divisions, construction of machines, tools and installations as well as surface treatment are also part of the product range.

Despite the international activities, the production, research and development as well administration divisions are still primarily based at the Company’s “place of birth” in Upper Franconia. At a global level, more than 4,000 employees sustain the Group’s success.

As a reliable partner SCHERDEL realizes innovative products for various areas. SCHERDEL guarantees complete solutions from the initial idea to the series production. The Group’s image is based on high-quality products used in the automotive sector as well as in medical devices, electronical applications and household appliances.

New forms of mobility are necessary to guarantee, also in the future, a quick, safe, comfortable and efficient transport for human beings and goods while preserving the resources. This requires the development of new drive systems with the necessary components. SCHERDEL actively participates in this challenge by offering innovative solutions.



SCHERDEL
Progress Based on Tradition

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