

Service.



Self-Study Programme 277

The Phaeton Chassis

Design and function



In top form, the Phaeton chassis fulfils even the most challenging demands on comfort and driving dynamics.

Through its components, including

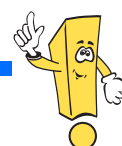
- Speed dependent power-assisted steering,
- Four-link front suspension,
- Trapezoidal wishbone rear suspension and
- ESP with braking assistant,

it achieves an important contribution towards active vehicle safety.



S277_033

NEW



**Caution
Note**



The self-study programme presents the design and operation of new developments! Contents will not be updated.

Current testing, adjustment and repair instructions may be found in the appropriate service material.

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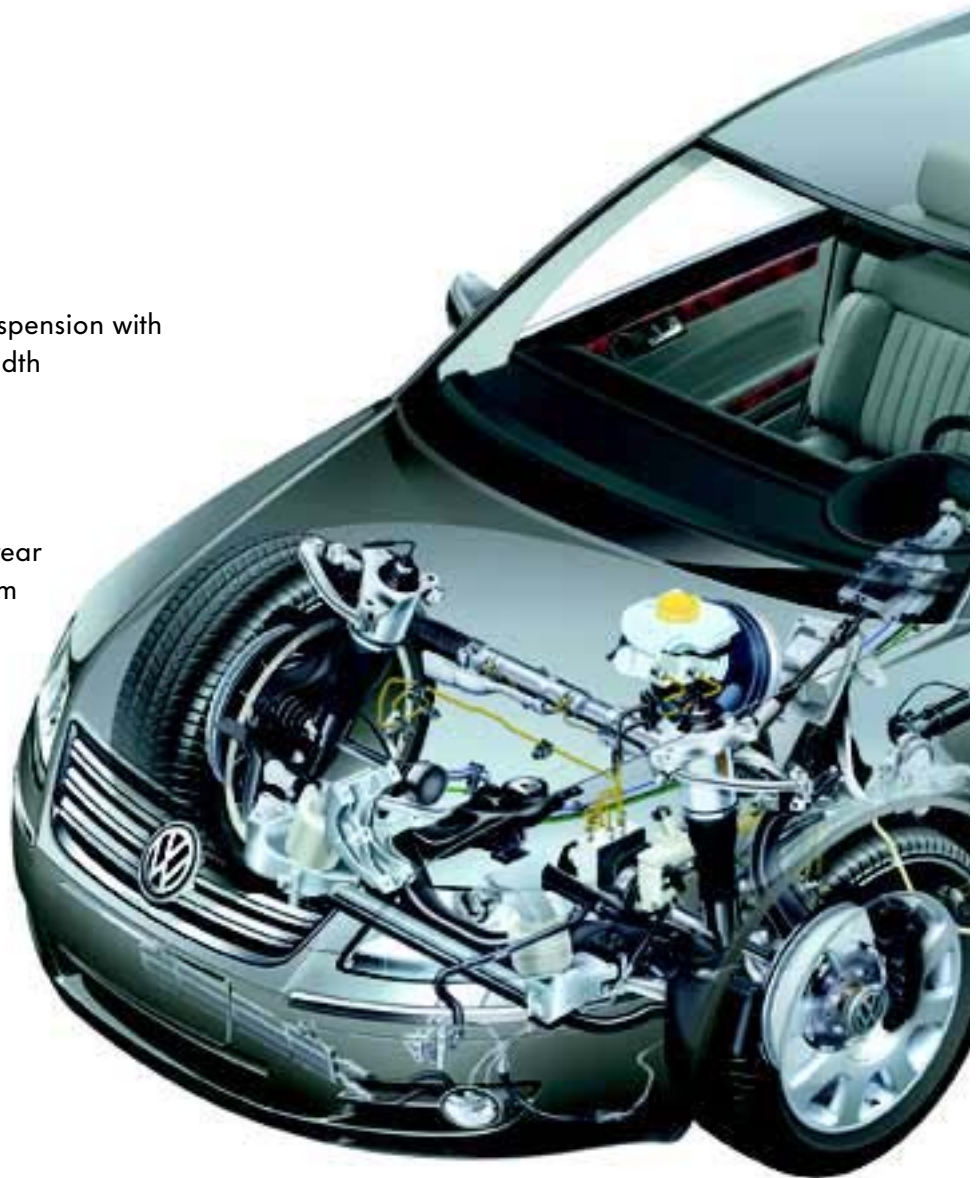


Introduction

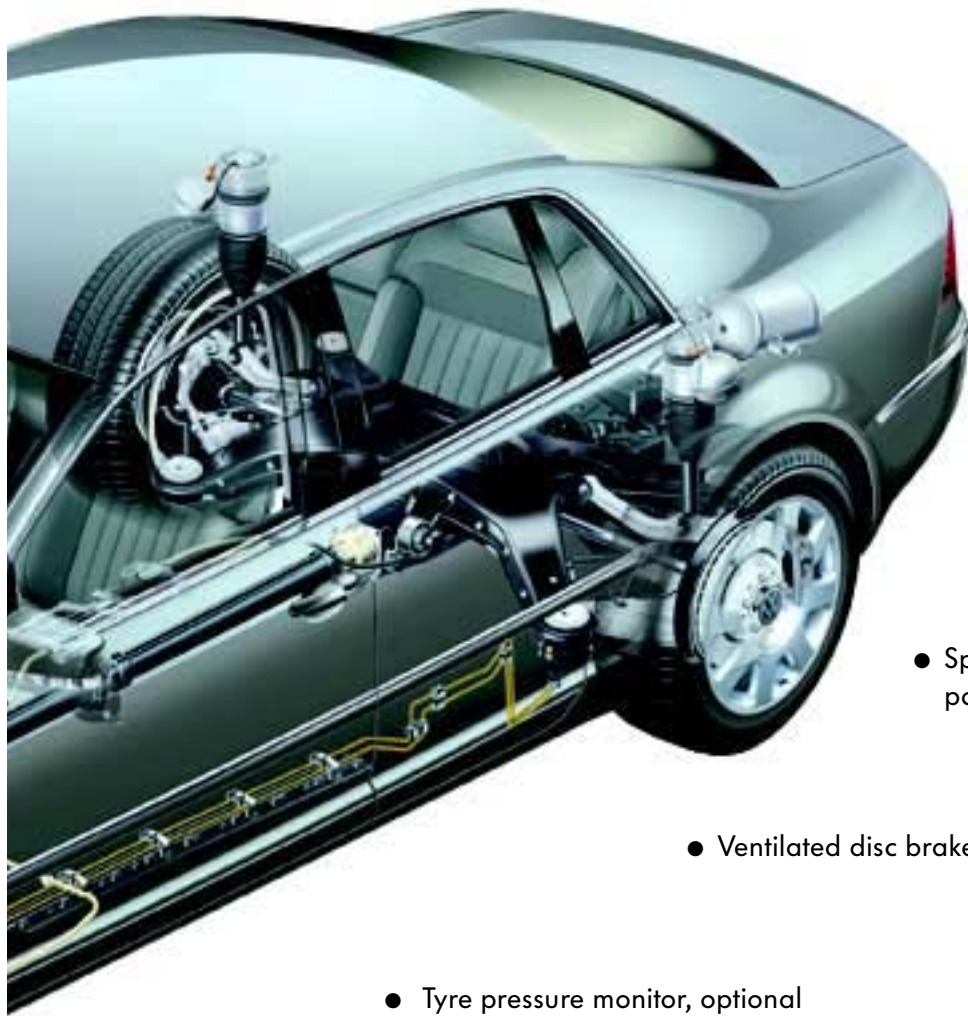


The chassis

- Four-link front suspension with 1628 mm track width
- Trapezoidal wishbone rear suspension with 1612 mm track width
- Front and rear anti-roll bars
- Independent wheel suspension front and rear
- 4-corner air suspension with regulated damping



S277_002



- Foot parking brake

- Braking assistant

- Speed dependent
power-assisted steering

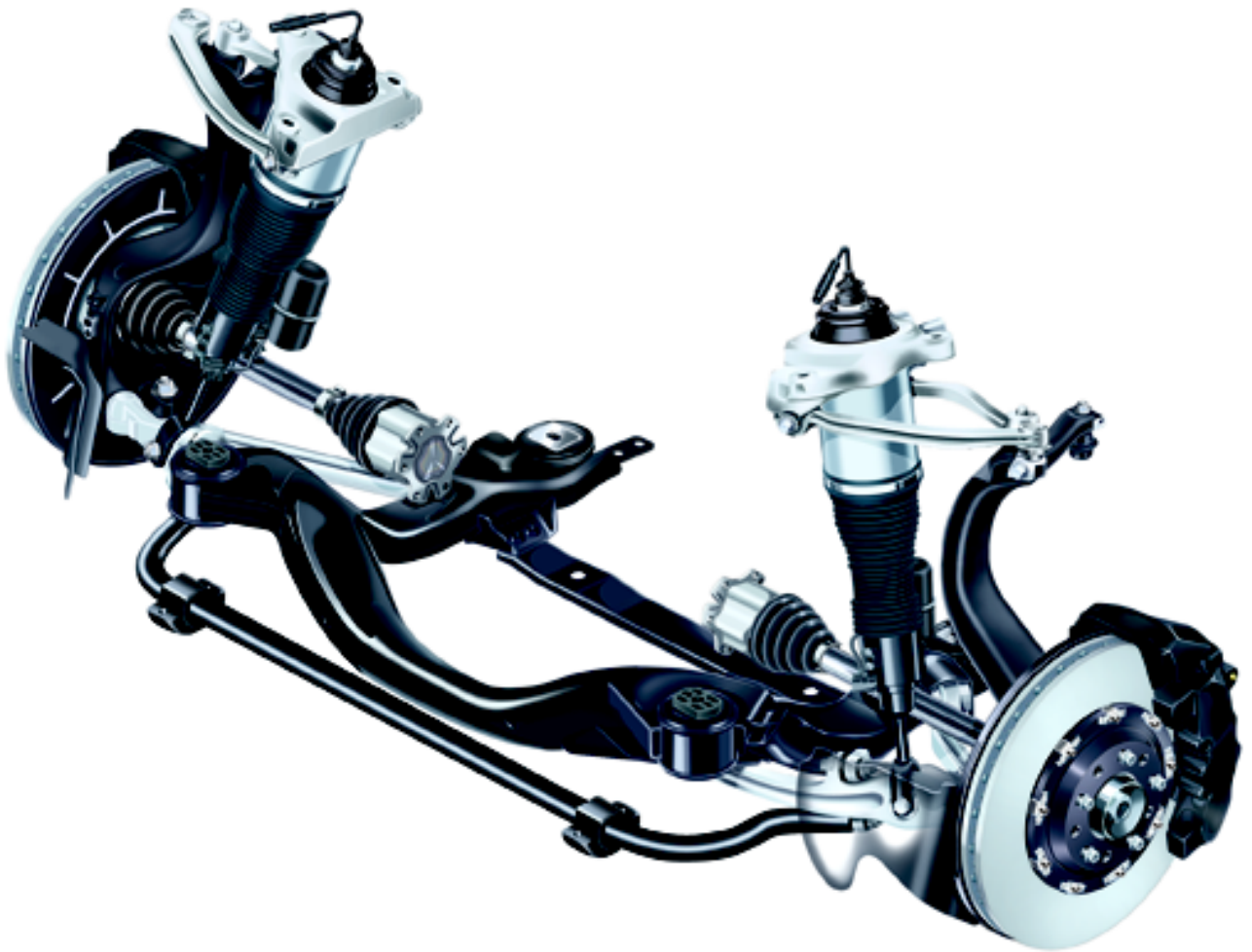
- Ventilated disc brakes

- Tyre pressure monitor, optional

- Electronic Stability Programme, Bosch 5.7

Front axle

The front axle

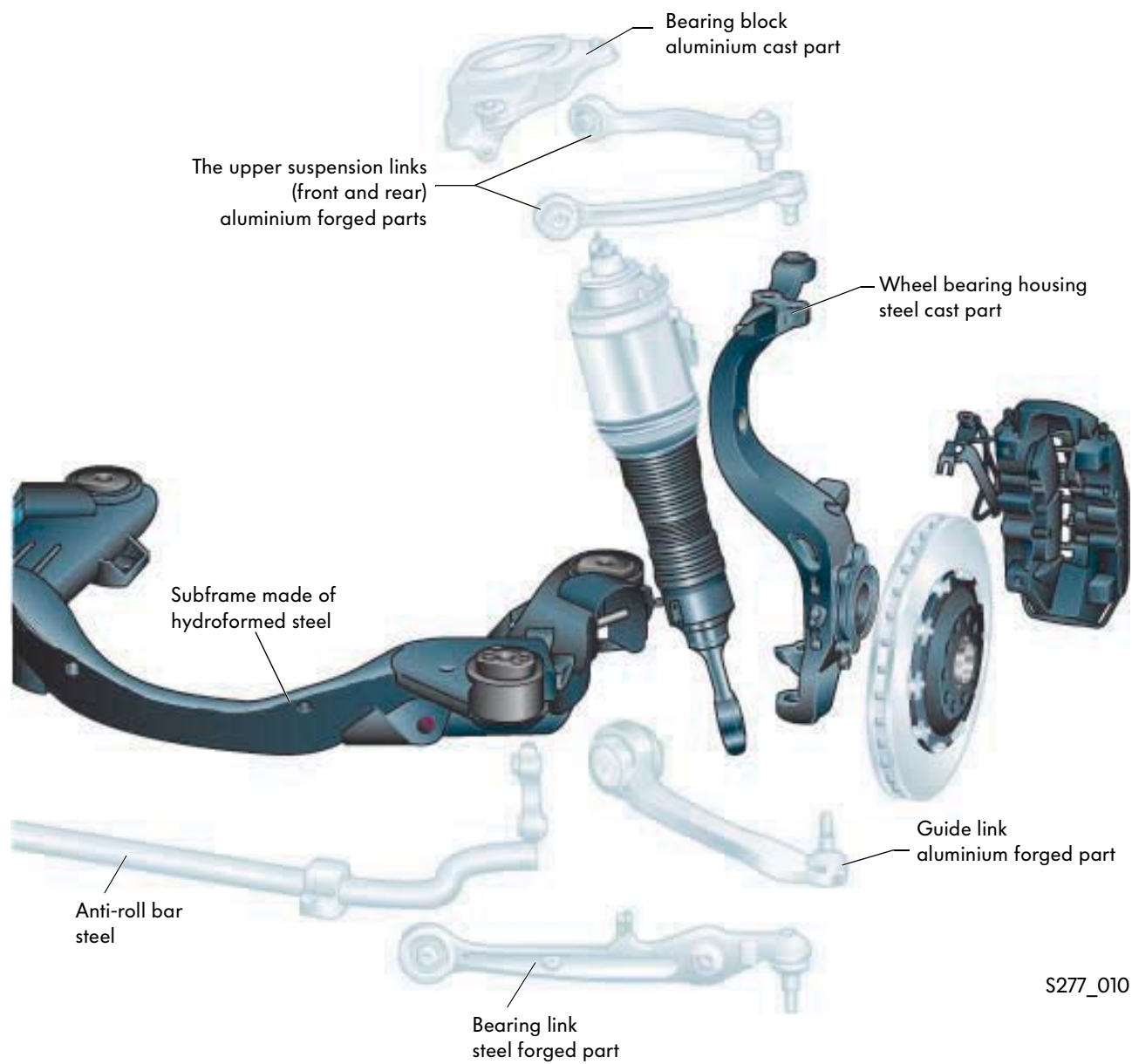


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The Phaeton's front axle is equipped with four-link suspension.
The multitude of guide elements produces the following advantages:

- Complete isolation of drive forces from the steering
- High steering precision through optimised positioning of the pivot axis
- Good driving comfort
- Exceptional anti-squat and anti-dive performance

The component overview



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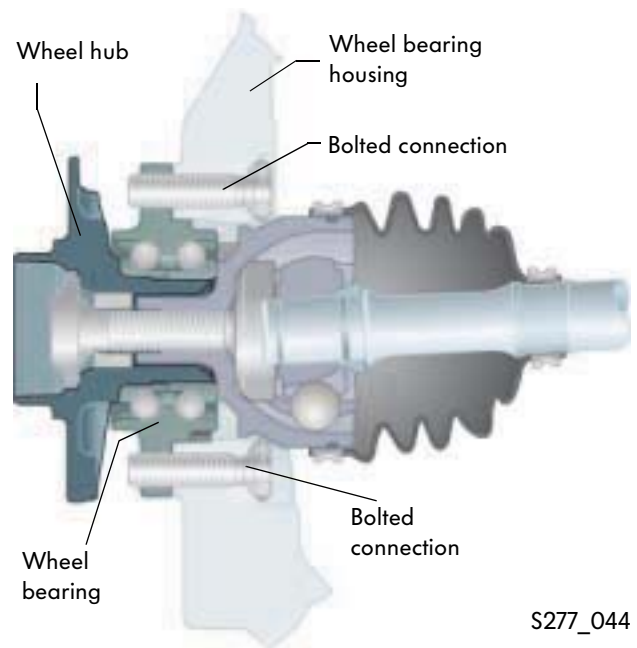


Front axle

The bolted wheel bearing

The wheel bearings are not pressed into the wheel bearing housing as was the practice up to now, but bolted directly to the wheel bearing housing as a unit (bearing and bearing housing).

This enables the wheel bearing to be installed without removing the pivot bearing or jointed shaft.



S277_044

The anti-roll bar

Depending on the engine, the Phaeton has either a solid anti-roll bar of 35 mm diameter or a tubular anti-roll bar of 35 mm diameter and 6 mm wall thickness.

The intermediate rubber bearings and aluminium pipe clamps are vulcanised on in this design and cannot be replaced.

This support arrangement, which was designed to have radially rigid and rotationally flexible characteristics, prevents noise and wear.



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The subframe

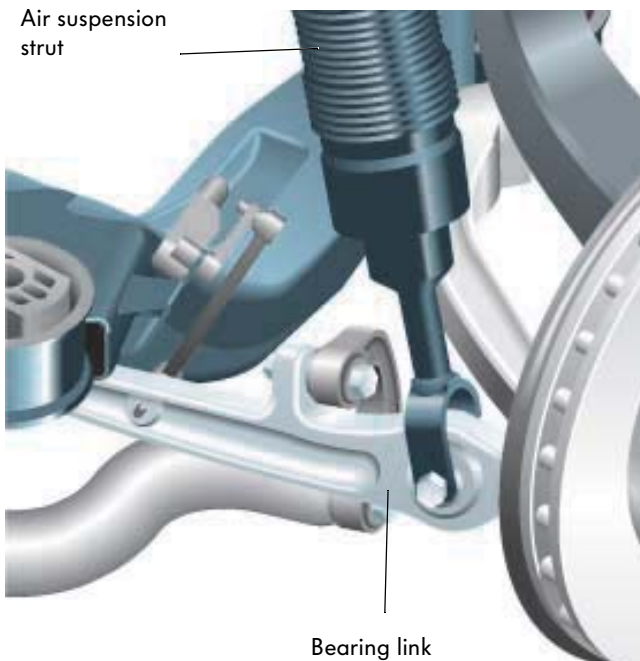


The high-pressure formed subframe of tubular steel is bolted to the body using rubber-metal bearings. This flexible connection keeps the body free of forces and impacts that the chassis introduces.

The additional bolted brace ensures ample transverse rigidity.



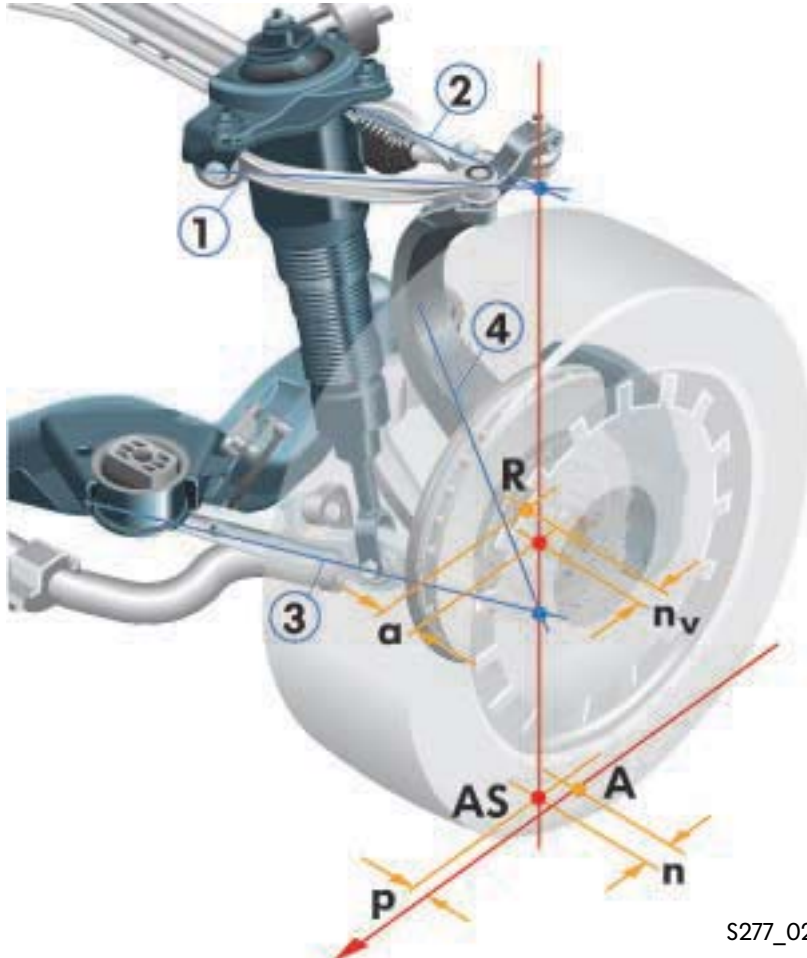
The connection of the air suspension strut to the suspension link



The air suspension strut is attached to the bearing link with a rubber-metal bearing.

Front axle

The virtual steering axis



1-4 Directions of the suspension links

R Wheel centre point

A Wheel contact point

n Trail

nv Caster offset

p Scrub radius

a Road feedback lever arm

Point AS = Piercing point of the steering axis on the roadway

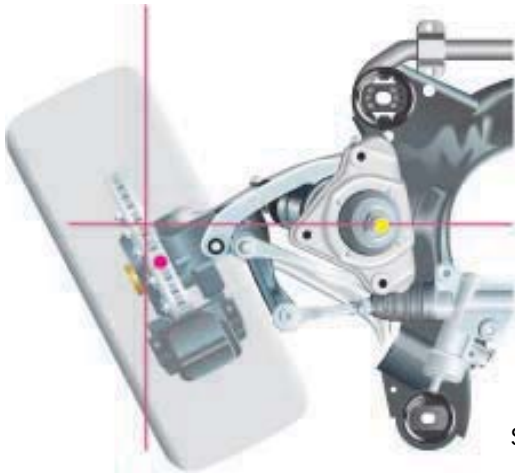
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With the four-link front suspension, the steering axis does not run through the upper and lower joints on the wheel bearing housing as with previously familiar front axle designs. Instead it runs through the intersection points formed by extrapolating the connection lines of the two upper and two lower suspension link joints respectively.

Thus, the suspension link axis is in free space and does not change position at full steering lock. This is why we refer to it as the virtual steering axis.

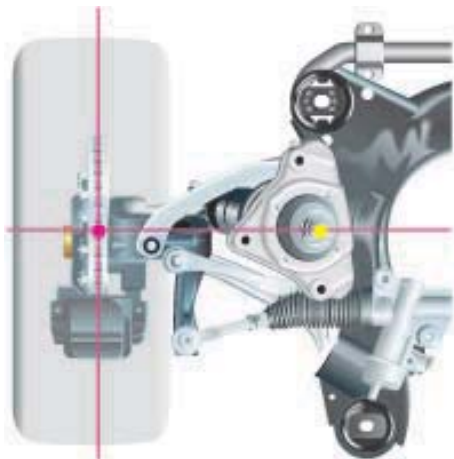
This arrangement enables the steering axis to be placed close to the wheel centre plane. This has a positive effect especially on the scrub radius and the road feedback lever arm, and thus produces advantages in driving behaviour.

The full steering lock positions



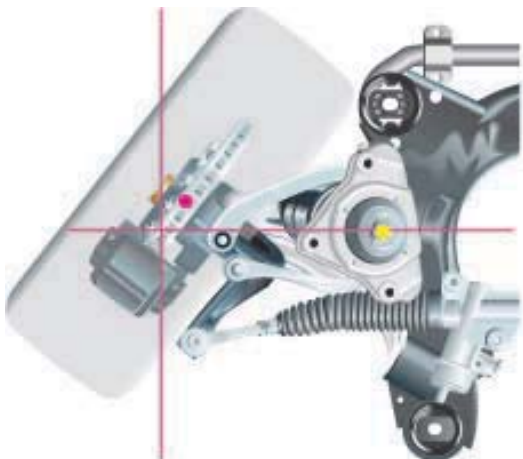
Link position for left curve

S277_070



Link position for straight driving

S277_040



Link position for right curve

S277_072

This axle design allows the virtual steering axis, around which the wheel moves and whose position determines the castor angle and the steering swivel inclination, to be shifted much further out. By optimising the axle geometry, it is possible to completely isolate torque steer effects on the steering.

Since the wheels are located using four ball sockets on the respective transverse links, the pivot axis can run approximately in the wheel centre independently of construction space requirements. The pivot axis is designed to change position according to the steering movements.

The defined movement of the axis when steering reduces the space requirements in comparison to conventional axle systems with fixed space steering axes.

The virtual steering axis changes position depending on the steering movements.



Rear axle

The rear axle, front wheel drive

In the Phaeton, the rear axle is designed with trapezoidal (unequal length) wishbone suspension. All wheel location elements are mounted to a subframe that is rigid in bending, torsion and warping.

This is connected to the body using large-dimensioned rubber bearings. This type of structure achieves exact wheel location and good ride.

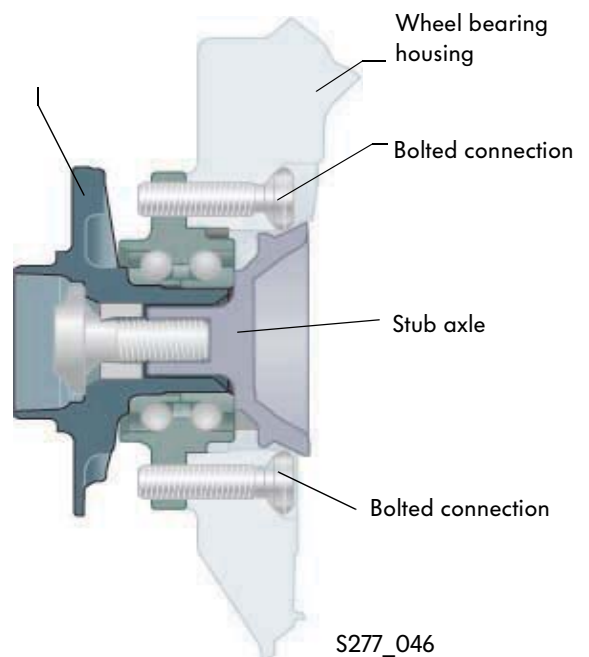


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The wheel hub

Instead of the bolted constant velocity (CV) joint pivot, the wheel bearing is prestressed with a stub axle.

The rear axle for front wheel drive vehicles is equivalent to the axle for all-wheel drive vehicles. Rear axle drive and jointed shafts are not used.



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The rear axle 4-motion

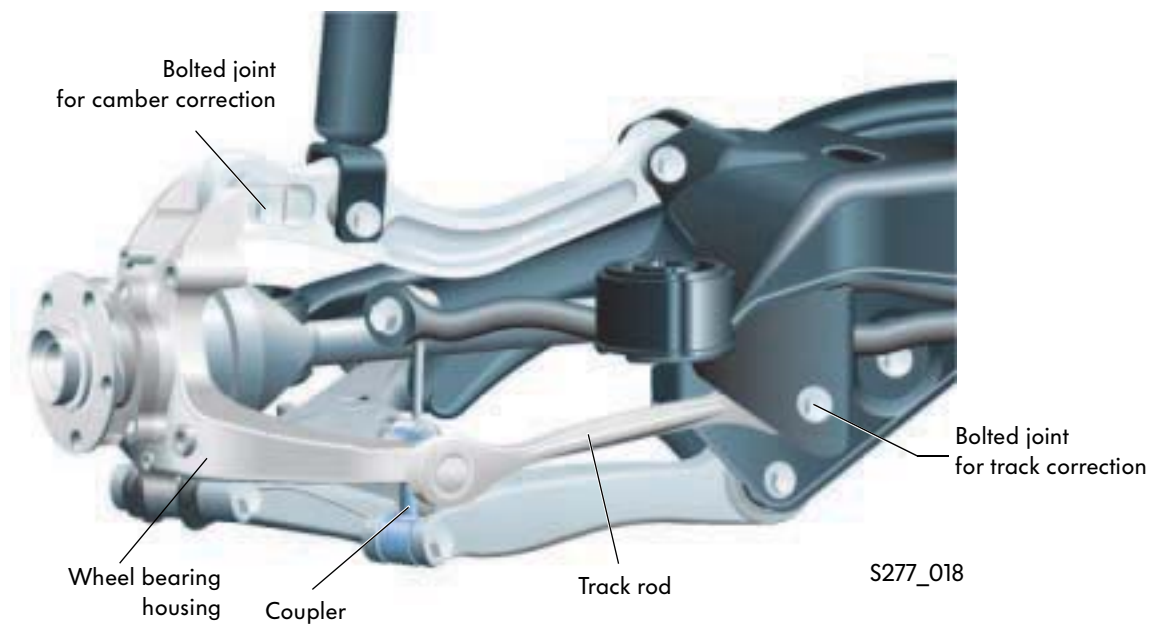
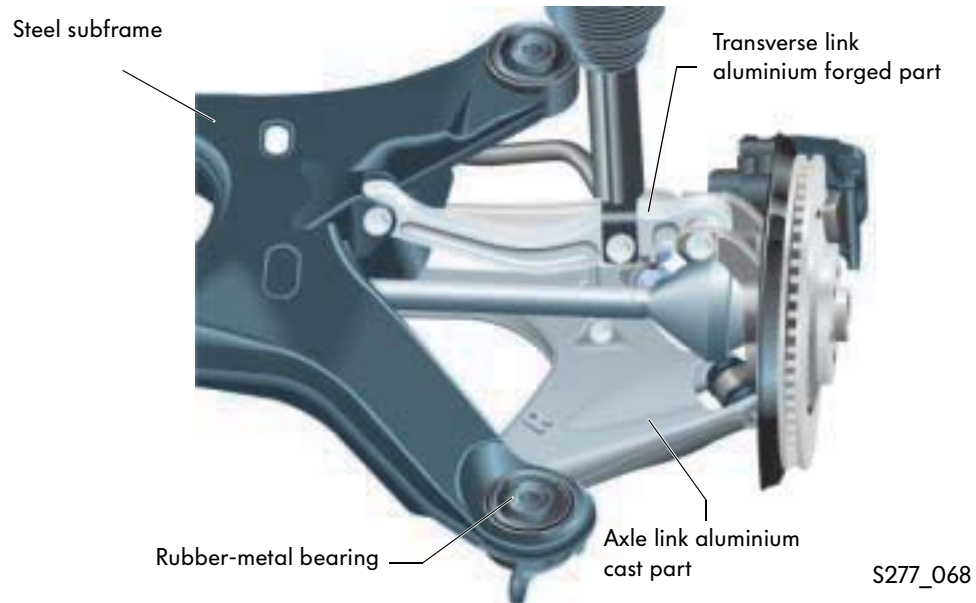
In the 4-motion version, the subframe holds the rear differential at three points. Therefore, the rear differential is doubly isolated from the body.



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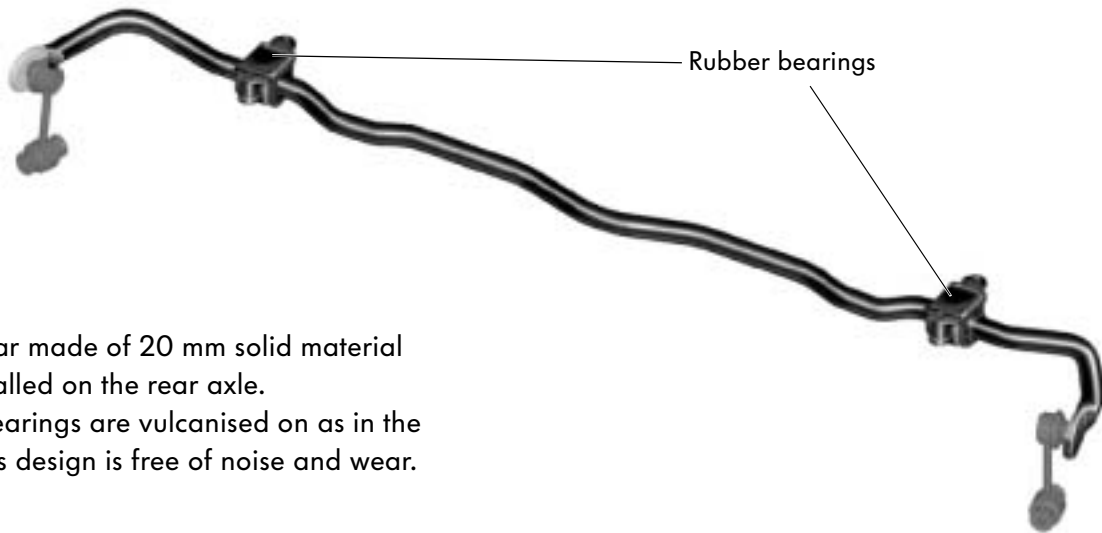
Rear axle



Integrating a coupler into the hub carrier connection and using a track rod has optimised the toe-in behaviour of the rear axle.

In particular, the passive steering properties and noise insulation have consistently improved.

The anti-roll bar

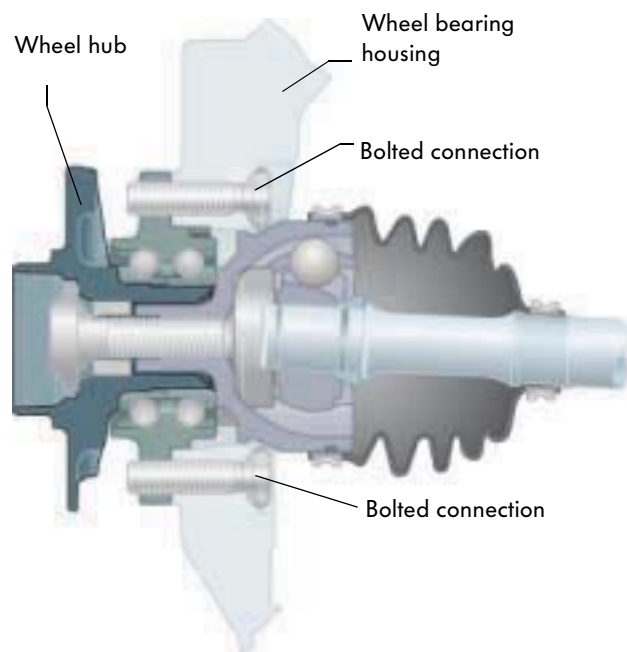


An anti-roll bar made of 20 mm solid material has been installed on the rear axle. The rubber bearings are vulcanised on as in the front axle. This design is free of noise and wear.

S277_031

The wheel bearing housing

With the rear axle, as with the front axle, the wheel bearings are bolted to the wheel bearing housing. The wheel bearings on the front and rear axles are identical in construction.



S277_044



Measurement

The particularities of measurement

The Phaeton is equipped with 4-corner air suspension as standard.

Before every measurement, the level position of each suspension strut must be checked.

When measuring the vehicle, the familiar parameters, camber and toe-in, must be adjusted on the rear or front axle.

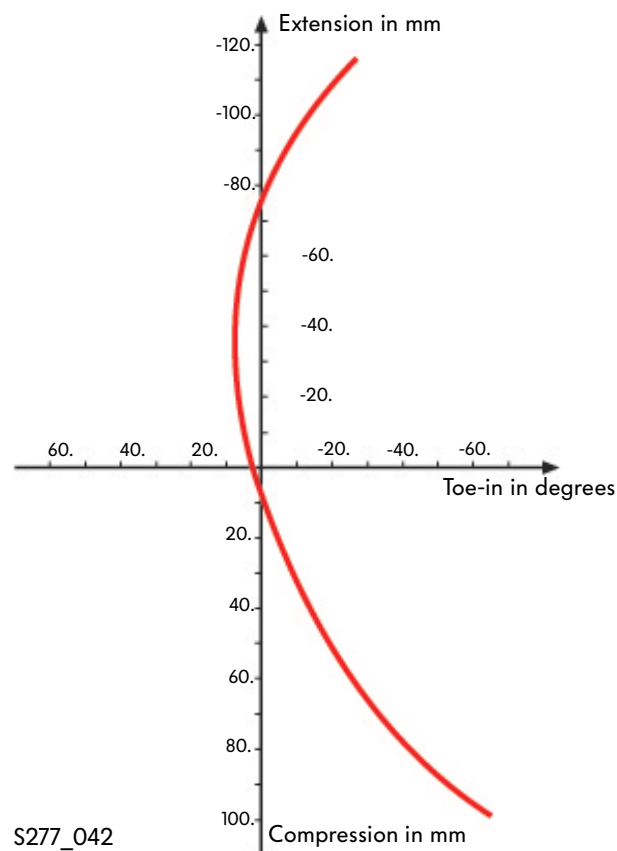
In addition, a toe-in value is set at the front axle when the suspension is extended.

The adjustment must be made with the wheel extended by 60 mm when the vehicle is empty.

Adjusting the toe-in curve with the wheel in an extended state sets the toe-in curve for driving stability.



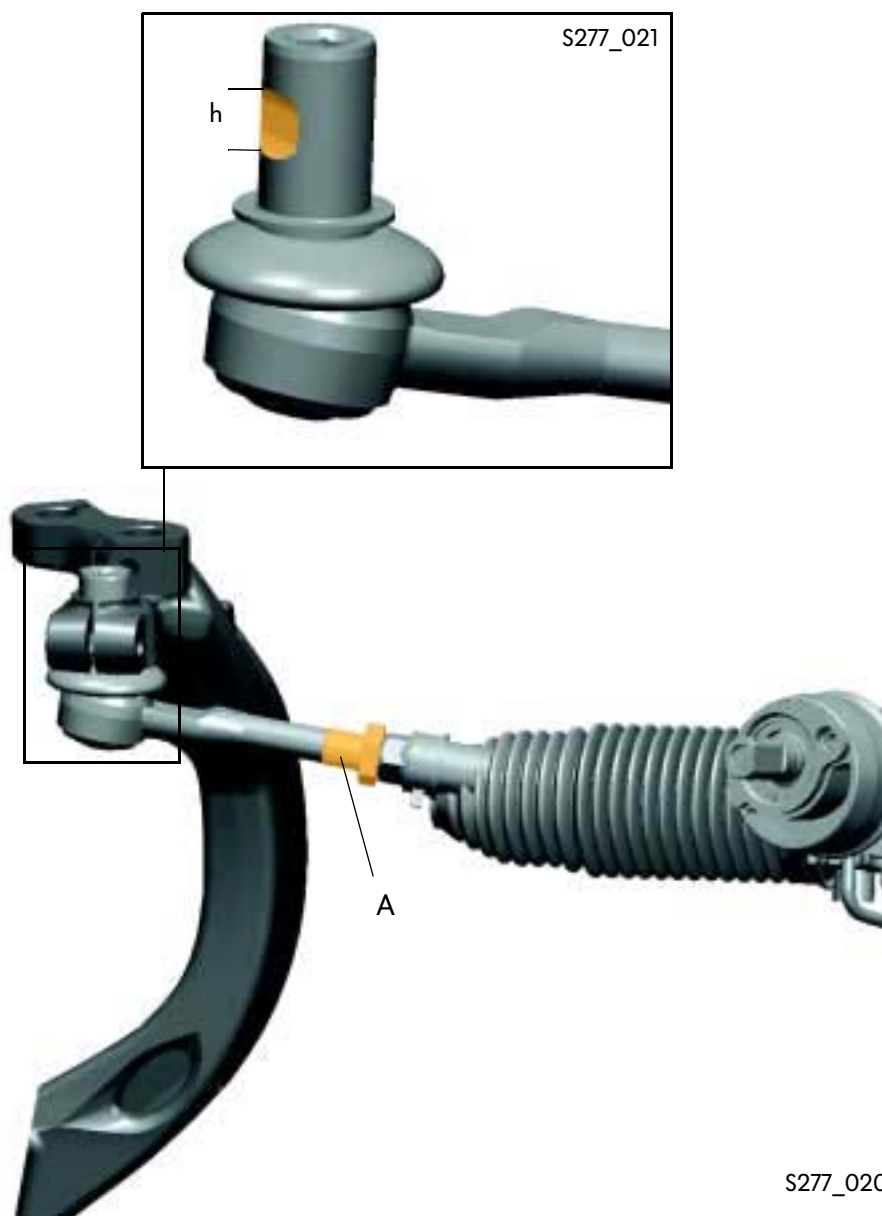
Toe-in curve diagram



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The following steps are important when performing the front-end alignment:

- Setting the basic toe-in with an empty vehicle by changing the length of the track rod
- Setting the inclination of the toe-in curve by changing the height of the outer track rod joint



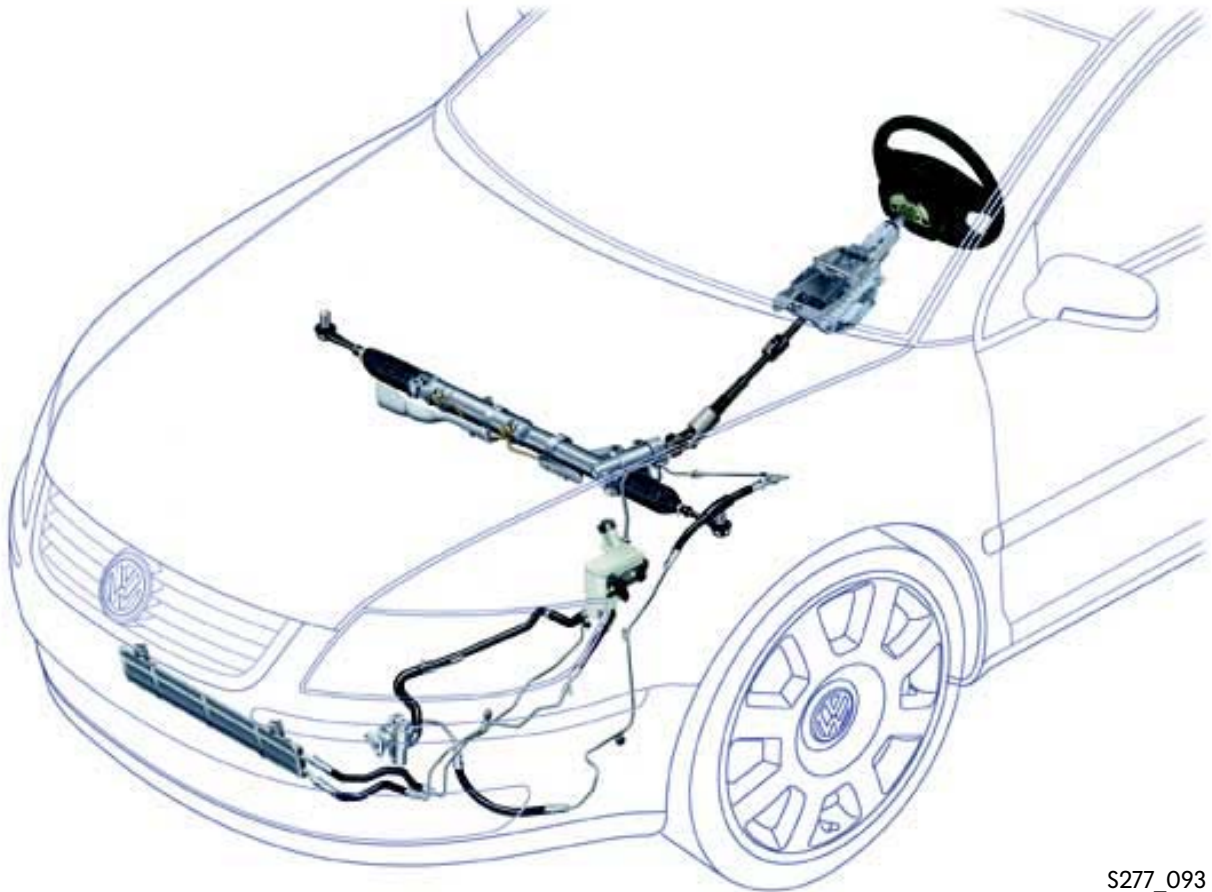
h = Adjustment range for the toe-in curve

A = Adjustment option for independent toe-in

Steering system

The steering system

Overview



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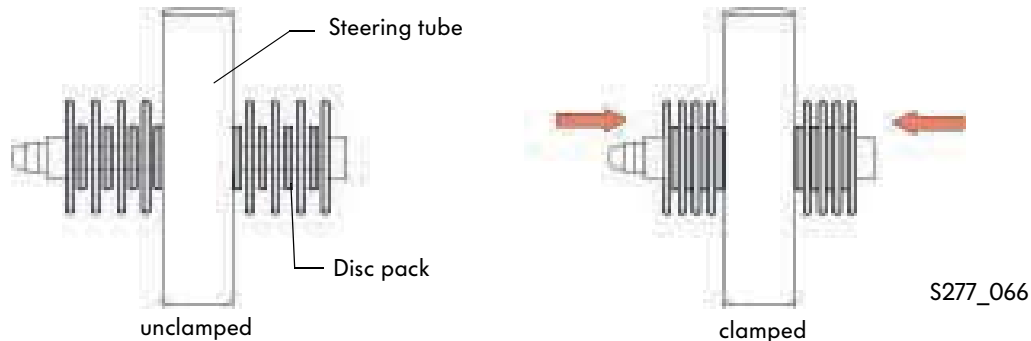
The steering column



S277_083

The Phaeton is equipped with an adjustable steering column. The travel range is 50 mm in the axial direction and 40 mm in the vertical direction. The steering column is available with either manual or electric adjustment.

Adjustment of the steering column - mechanical adjustment



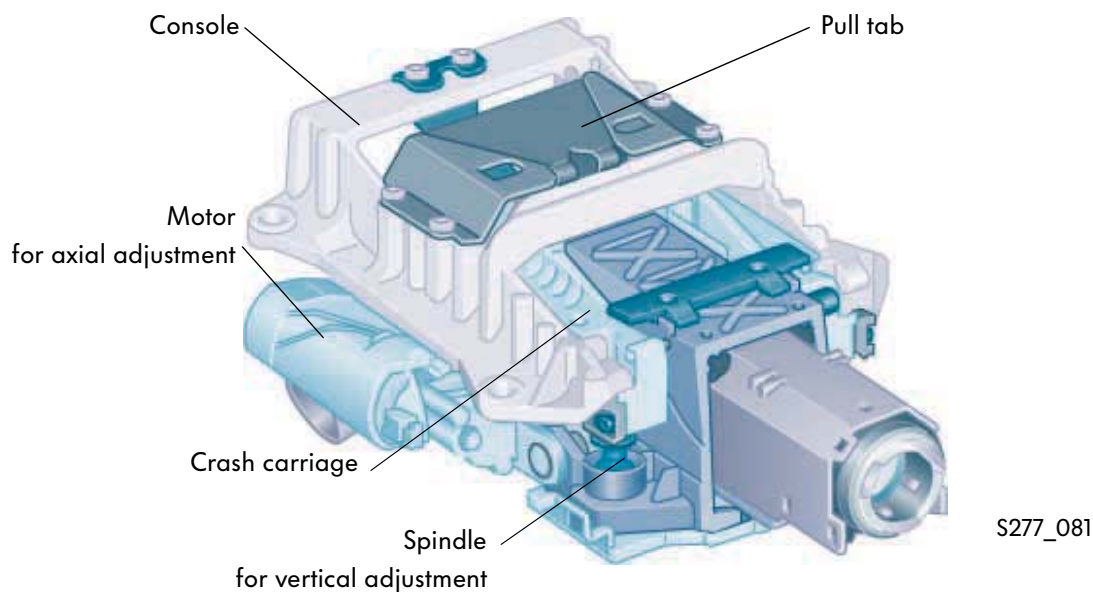
With manual adjustment, eight steel discs lock the steering column in place on each side of the steering tube using a clamping mechanism. Here there are four discs for axial adjustment and four discs for vertical adjustment per side.

The advantage: infinite adjustment with high holding forces.

Adjustment of the steering column - electrical adjustment

The electric steering column is essentially the same in concept as the manually adjustable steering column with reference to kinematics, adjustment field, installation space, connection and crash concept.

The electric steering column is infinitely adjustable in the axial and vertical directions and is driven by electric motors.



Steering system

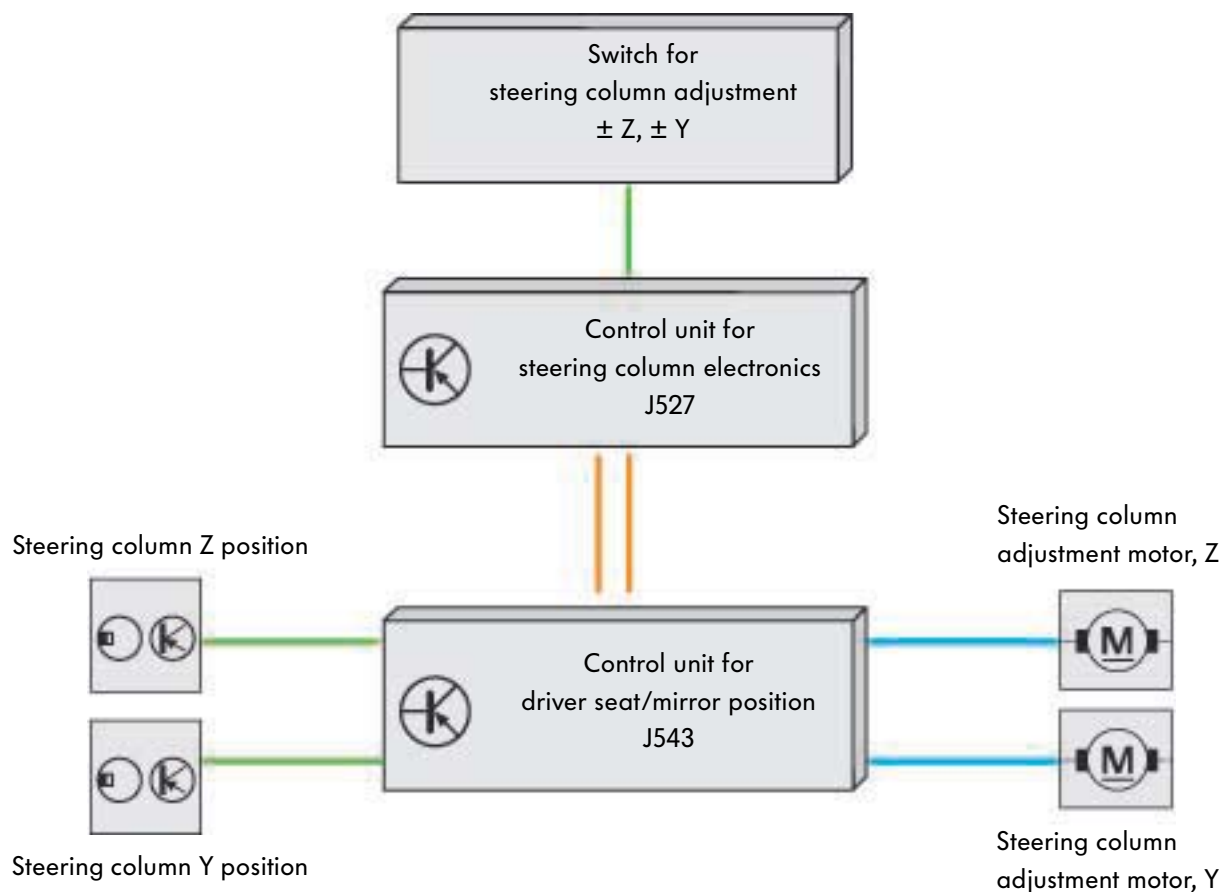
Adjustment of the steering column - circuit diagram

The comfort CAN bus carries the command signal to adjust the steering column, and the control unit for driver seat/mirror position processes it.

The steering column electronics control unit interprets and reads the driver's wish from the steering column adjustment button and places the signal on the comfort CAN bus.

The control unit for driver seat/mirror position then sets the motors to the corresponding position.

Hall sensors in the adjuster motors send the return signal to the control unit for driver seat/mirror position.

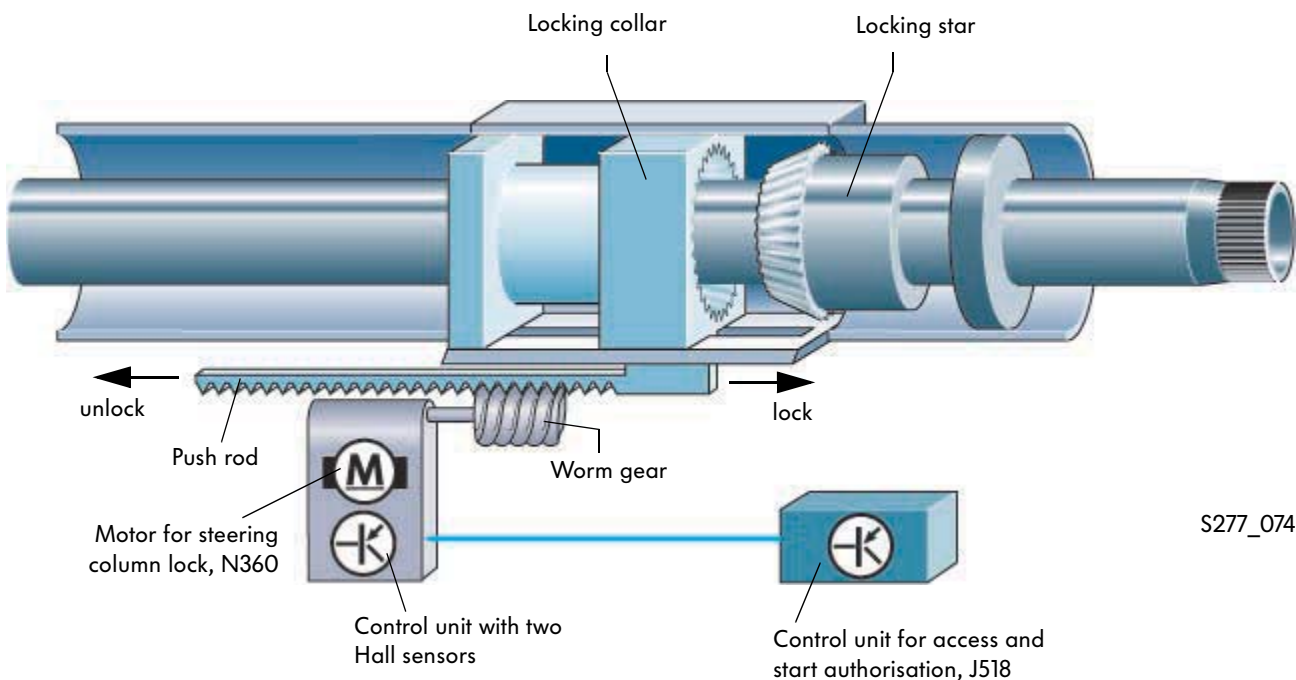


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The electric steering column lock

The Phaeton uses an electric steering column lock instead of a mechanical steering lock.

The electric steering column lock is an integrated system with an electrical interface to the access and start authorisation control unit and a mechanical interface to the steering column.



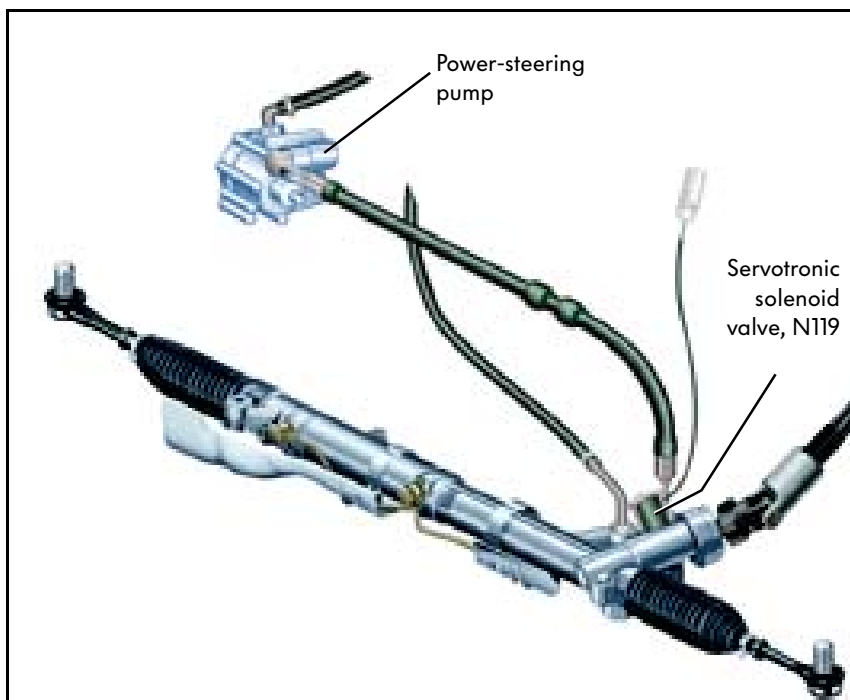
When the electric motor is activated, the worm gear moves the push rod in the longitudinal direction. To lock the steering column (terminal 15, out), the inner-toothed locking collar is pushed over the conical, outer-toothed locking star until it stops. To unlock the steering column (terminal S, in), the locking collar is pulled away from the locking star.

Steering system

The Servotronic

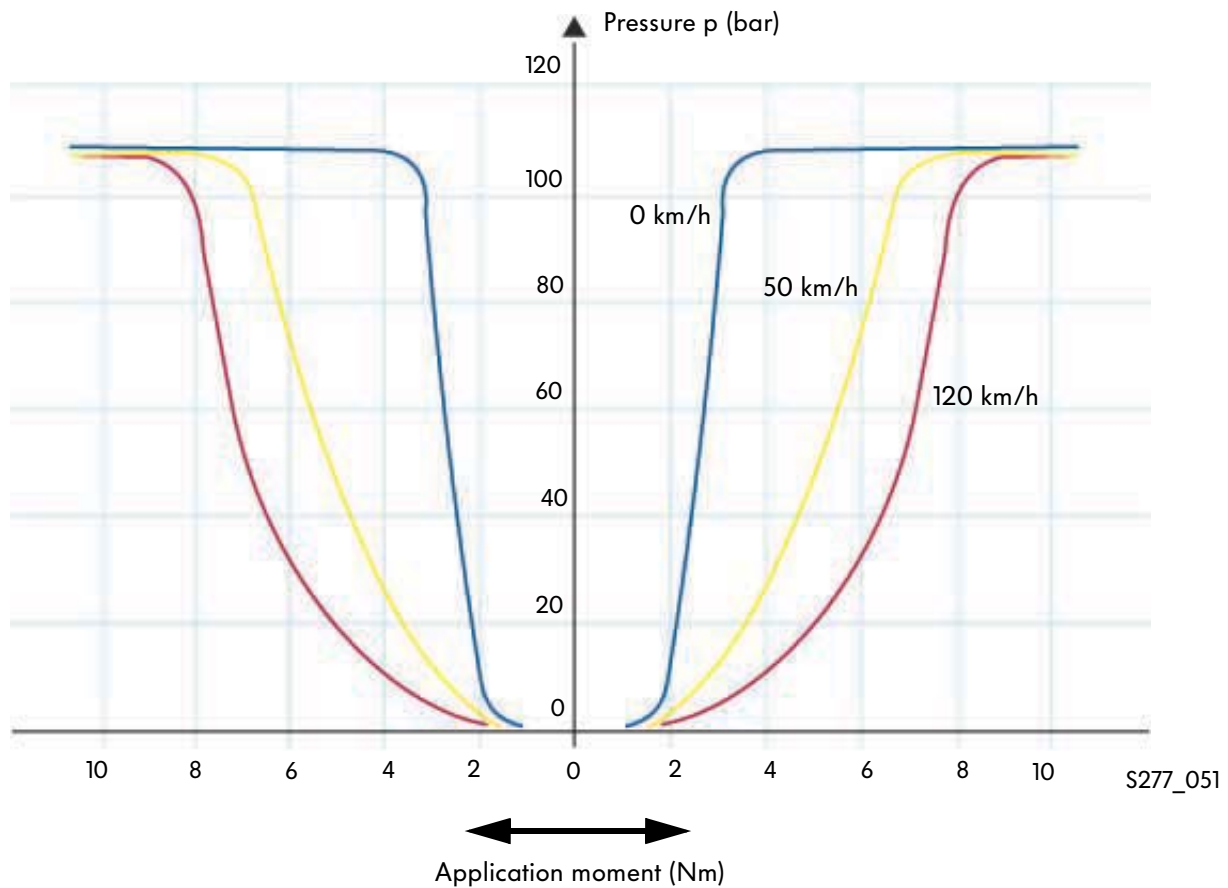
Design and function

The Phaeton is equipped with Servotronic. This hydraulic steering system, which is electronically controlled and speed dependent, is distinguished by light, comfortable steering while parking and a safe driving feel with increasing speed.



S277_049

The Servotronic characteristic curve diagram



The diagram shows how the pressure changes with respect to application moment in relation to driving speed.

The characteristic curve has been specifically adjusted to the vehicle character.

The Servotronic steering system is based on hydraulic steering.

The hydraulic steering's modified rotary valve uses the principle of direct hydraulic reaction (feedback).

Using an electro-hydraulic converter and reconfiguring the steering valve accordingly has enabled the Servotronic system to operate according to driving speed.



Steering system

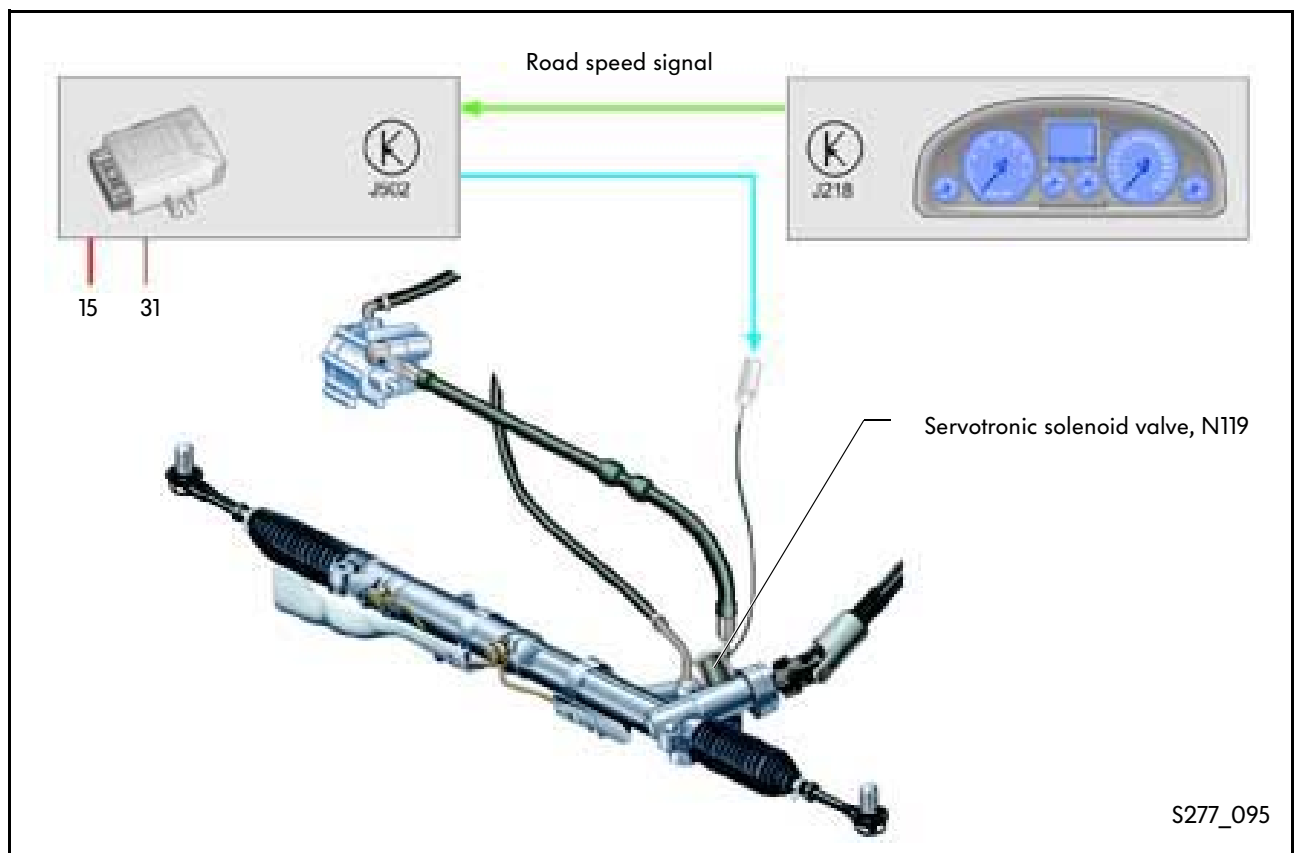
The electric control

The Servotronic control unit evaluates the road speed signal from the dash panel insert and converts the signal into modulated current. This actuates the N119 solenoid valve.

The N119 solenoid valve determines the hydraulic reaction at the rotary valve and thus the application moment at the steering wheel.

The speed dependent influence on the steering translates into minimum forces required for steering at still stand and low speeds.

Since the hydraulic reaction changes in relation to driving speed, the application force at the steering wheel increases with increasing speed. This gives the driver especially good contact with the roadway, allowing the driver to steer accurately.



Safety with the Servotronic system

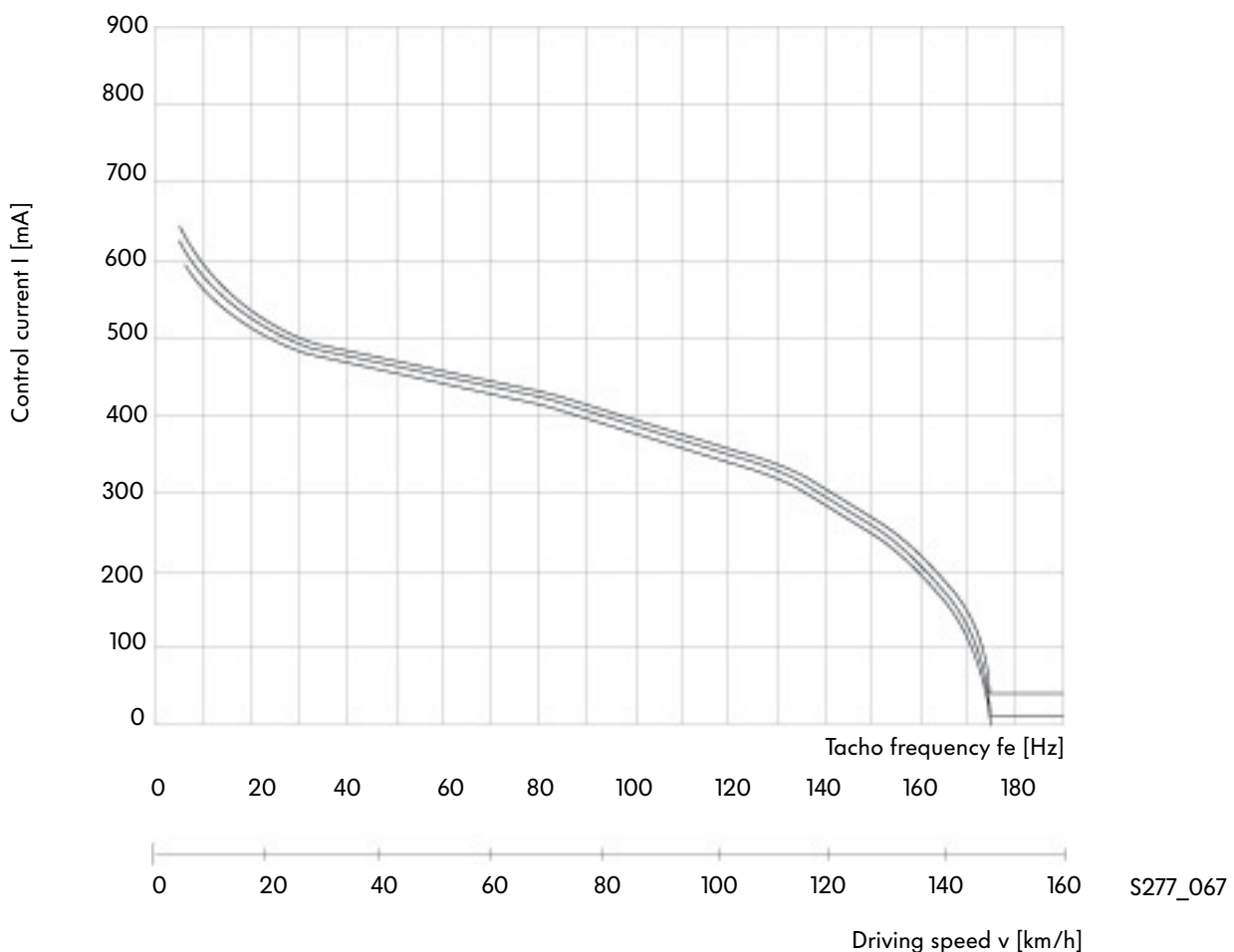
The steering system remains fully functional if the vehicle electrical system fails or other electrical faults occur.

The Servotronic system then works using the mechanical forced opening of the N119 solenoid valve at maximum hydraulic reaction (fast speed characteristic curve).

If the road speed signal fails while driving, the Servotronic system remains at the last given control range until the ignition is switched off.

The next time the motor is started, the maximum hydraulic reaction develops, according to the fast speed characteristic curve.

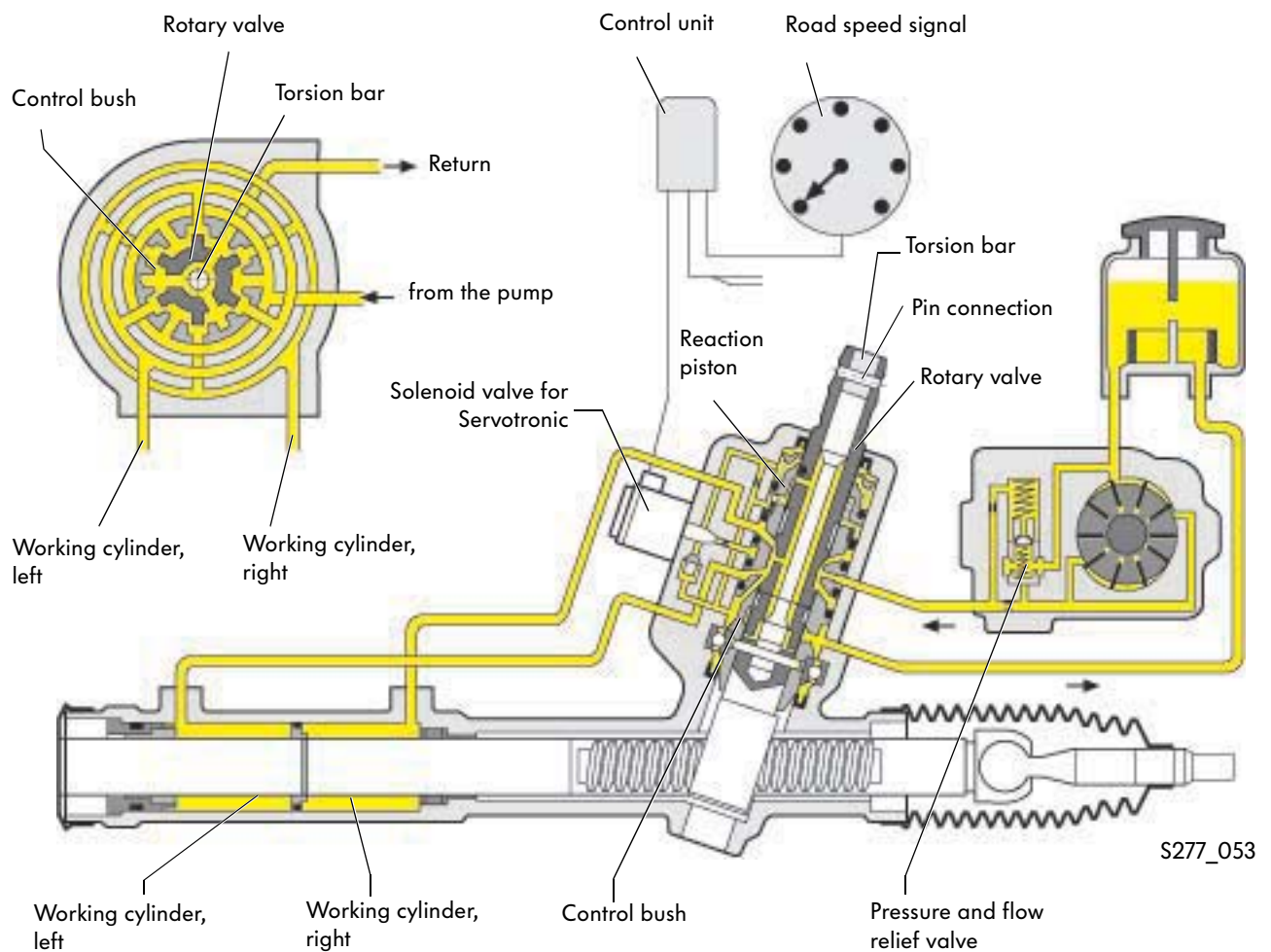
The characteristic curve for control current to the solenoid valve



Steering system

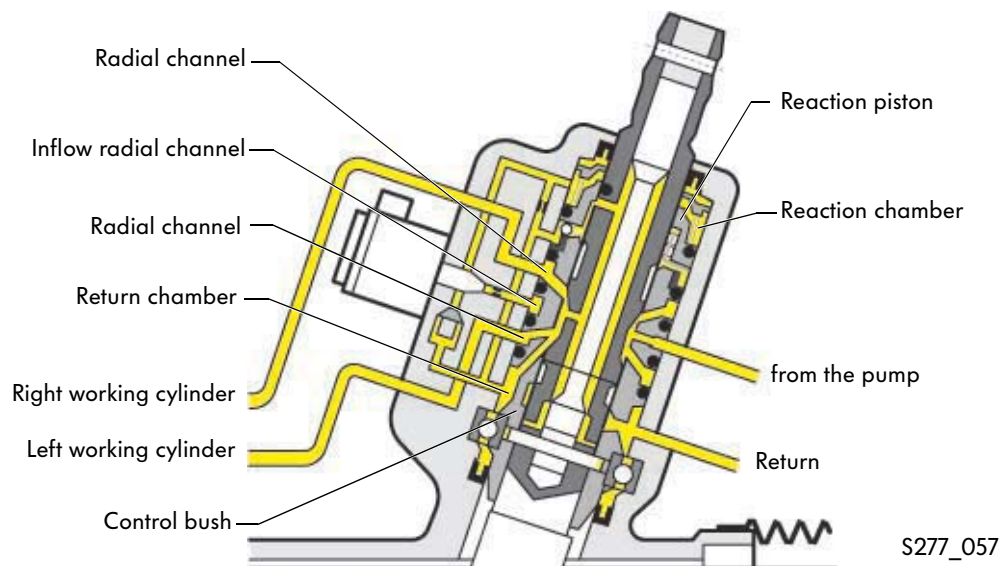
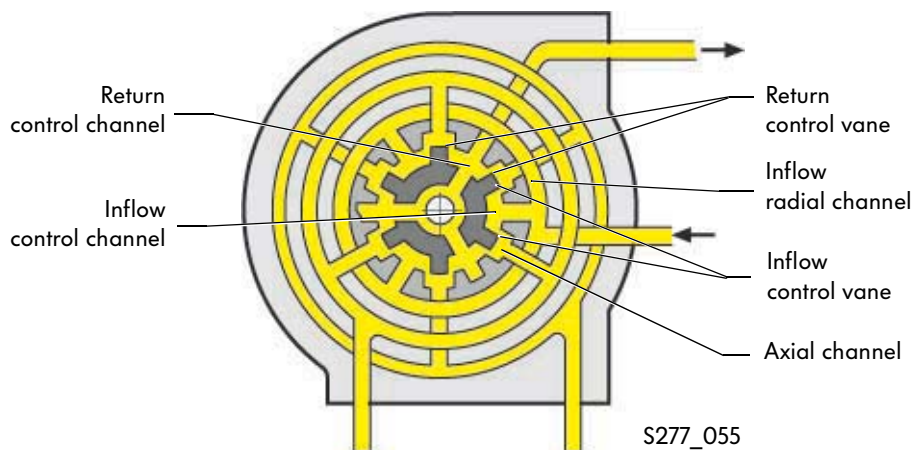
The rotary valve in neutral position - vehicle stationary

The familiar hydraulic pump generates the pressure that the Servotronic system requires, about 130 bar, which is transferred to the rotary valve. In the valve unit is a torsion bar, which is pinned to the rotary valve on one side and to the driving pinion and control bush on the other side. The torsion bar is responsible for centering (neutral position).



The oil that the hydraulic pump supplies flows through the connection hole in the valve region and into the inflow radial channel. It then flows into the cross holes in the control bush to the inflow control channels in the rotary valve. In the valve neutral position, the oil flows via the open inflow control vanes into all axial channels in the control bush. From there it flows via the open return control vanes also into the return control channels in the rotary valve.

From these channels, the oil can flow through connections into the return chamber, and from there back to the oil reservoir. At the same time, the radial channels in the valve body and the associated tube lines connect the right and left working cylinder chambers.



Steering system

The rotary valve in working position, left full steering lock - driving at low speed

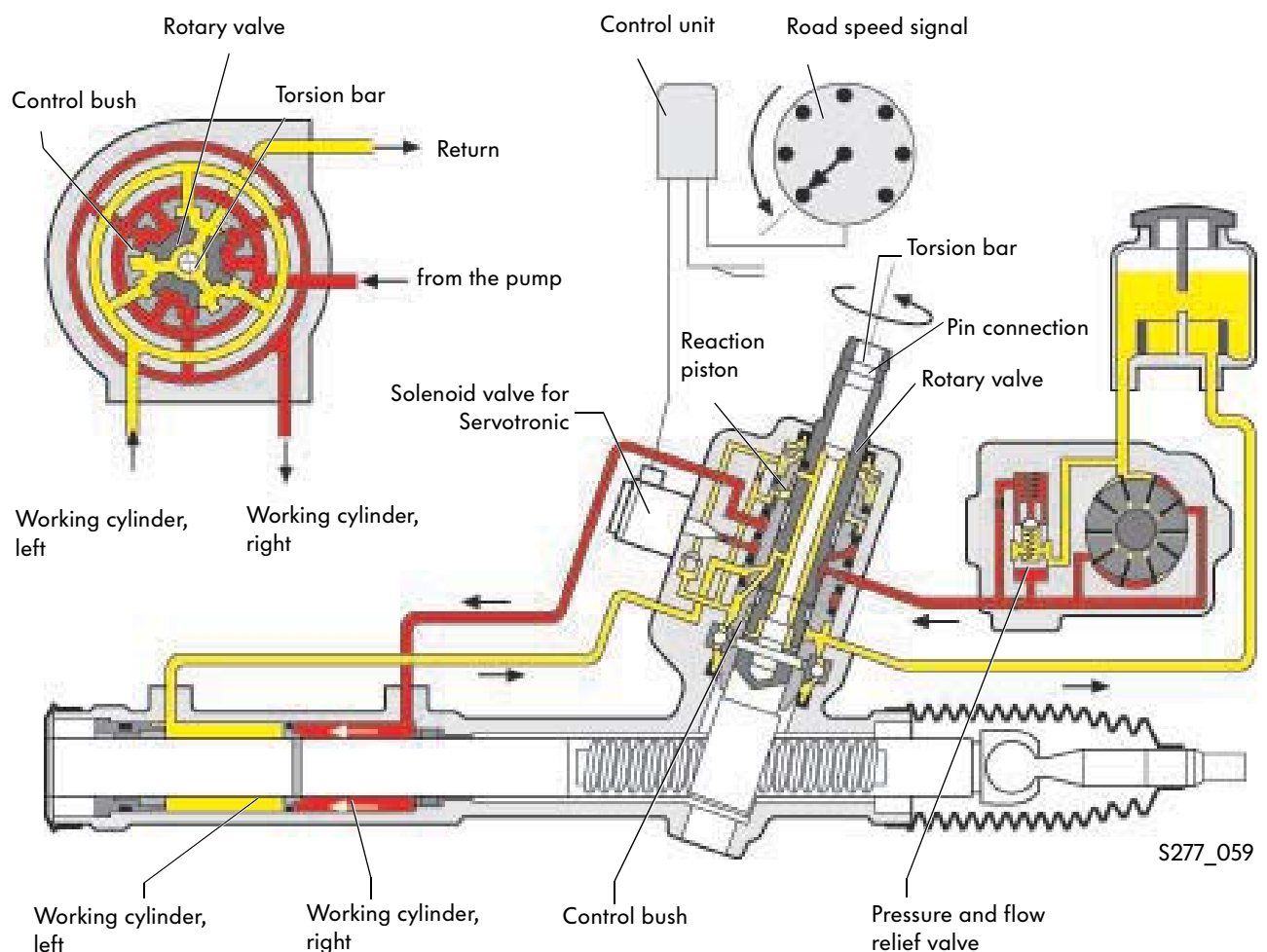
At left full steering lock, oil must flow to the right side of the working cylinder to assist the steering effort.

The force at the steering wheel turns the torsion bar in its elastic range, since it is pinned to the rotary valve at the top and to the control bush and driving pinion at the bottom.

The torsion bar, which narrows in the appropriate region, turns the rotary valve against the control bush.

The pressurised oil travels via the inflow control vanes, which are further open, into the associated axial channels, through the hole in the radial channel and via a tube line to the right cylinder chamber, thus hydraulically assisting the steering rack to move. The pressurised oil in the right cylinder chamber pushes the oil out of the left cylinder chamber into the return line.

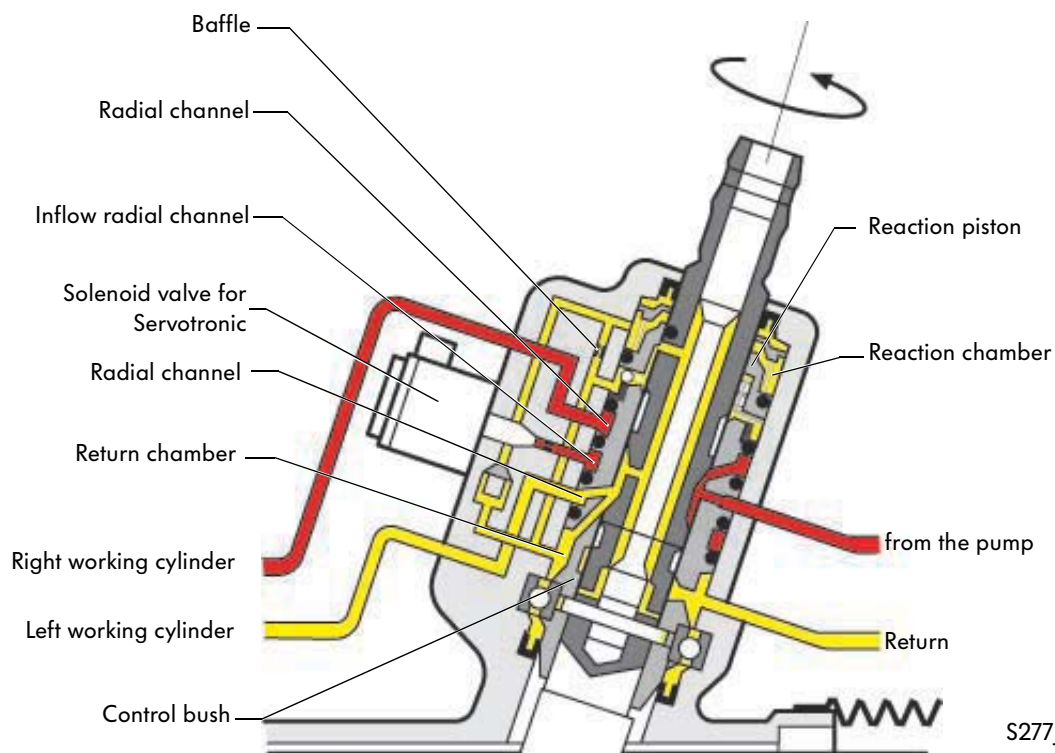
If the driver releases the steering wheel, the torsion bar ensures that the rotary valve and the control bush spring back into the neutral position.



The servotronic control unit evaluates the road speed signal and passes it on to the N119 solenoid valve as modulated control current.

Due to the maximum current produced in this driving situation, the N119 solenoid valve closes and prevents oil from flowing from the inflow radial channel to the reaction chamber.

A baffle ensures that the return pressure level also acts in the reaction chamber. Thus, the Servotronic rotary valve behaves as a normal rotary valve in this situation. The steering is light and can be operated with little effort since the reaction has been eliminated.



S277_061



Steering system

The rotary valve in working position, right full steering lock - driving at high speed

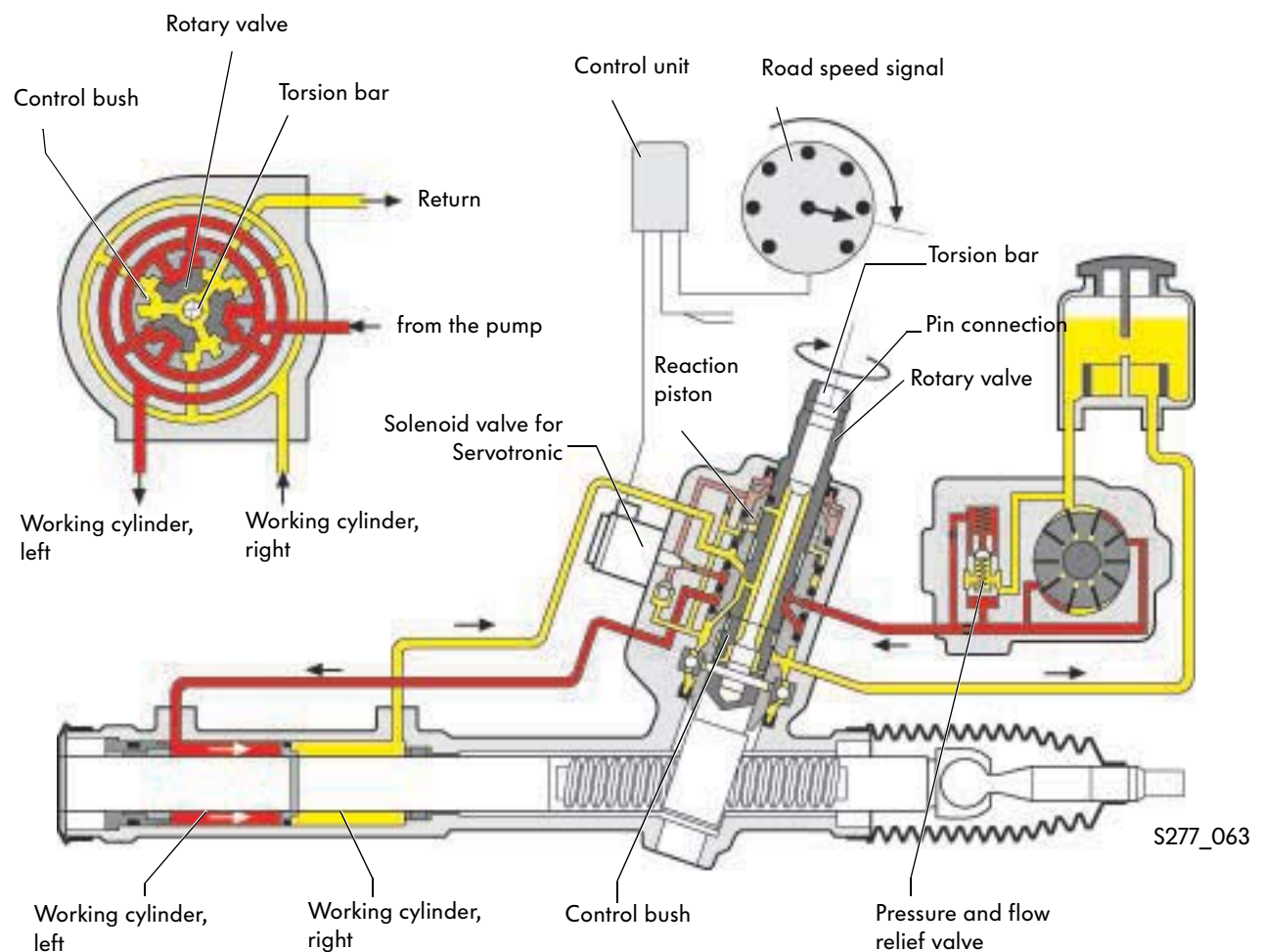
At right full steering lock, oil must flow to the left side of the working cylinder to assist the steering effort.

The force at the steering wheel turns the torsion bar in its elastic range, since it is pinned to the rotary valve at the top and to the control bush and driving pinion at the bottom.

The torsion bar, which narrows in the appropriate region, turns the rotary valve against the control bush.

The pressurised oil travels via the inflow control vanes, which are further open, into the associated axial channels, through the hole in the radial channel and via a tube line to the left cylinder chamber, thus hydraulically assisting the steering rack to move.

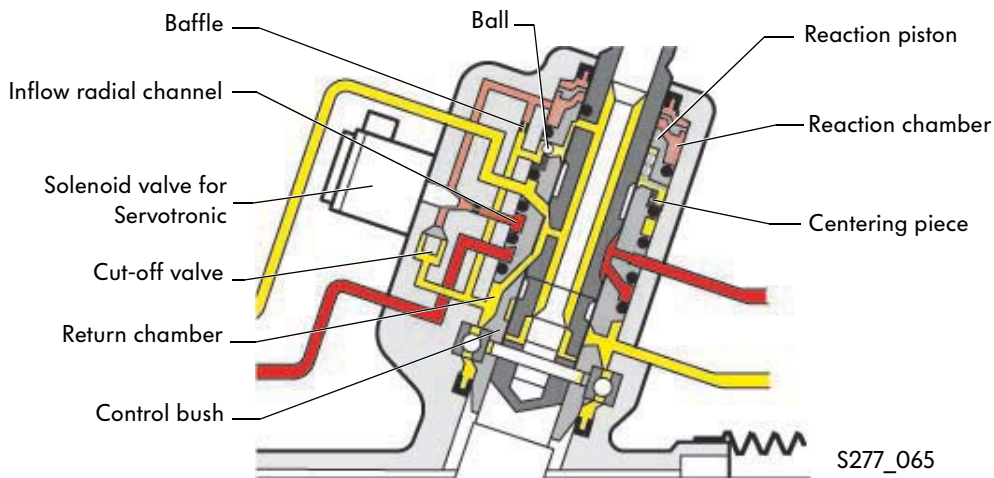
The pressurised oil in the left cylinder chamber pushes the oil out of the right cylinder chamber into the return line. If the driver releases the steering wheel, the torsion bar ensures that the rotary valve and the control bush spring back into the neutral position.



S277_063

As the speed increases, the Servotronic control unit reduces the control current to the N119 solenoid valve. With this, the N119 solenoid valve takes on a certain opening position and enables a limited oil inflow from the inflow radial channel into the reaction chamber. A baffle prevents large amounts of oil from flowing out into the return chamber, so that higher pressure develops in the reaction chamber. The increased pressure acting on the reaction piston then generates a greater pressing force on the balls guided by V-ways. These balls are located between the reaction piston and the centering piece, which is firmly joined to the control bush.

During straight driving, this has a positive effect on the centering of the rotary valve, making it particularly exact. When the rotary valve pivots, the balls, which are now more highly loaded, exert additional resistance against turning of the rotary valve. Therefore, with the hydraulic reaction in this sequence of operations, the specifically determined application moment required to move the steering wheel is higher.



At high driving speeds, the N119 solenoid valve is completely open due to the very low or zero control current. Thus, the inflow radial channel supplies maximum pressure to the reaction system. When the driver turns the steering wheel to the right, the reaction pressure also increases corresponding to the prevailing operating pressure and pushes the reaction piston out of the reaction chamber.

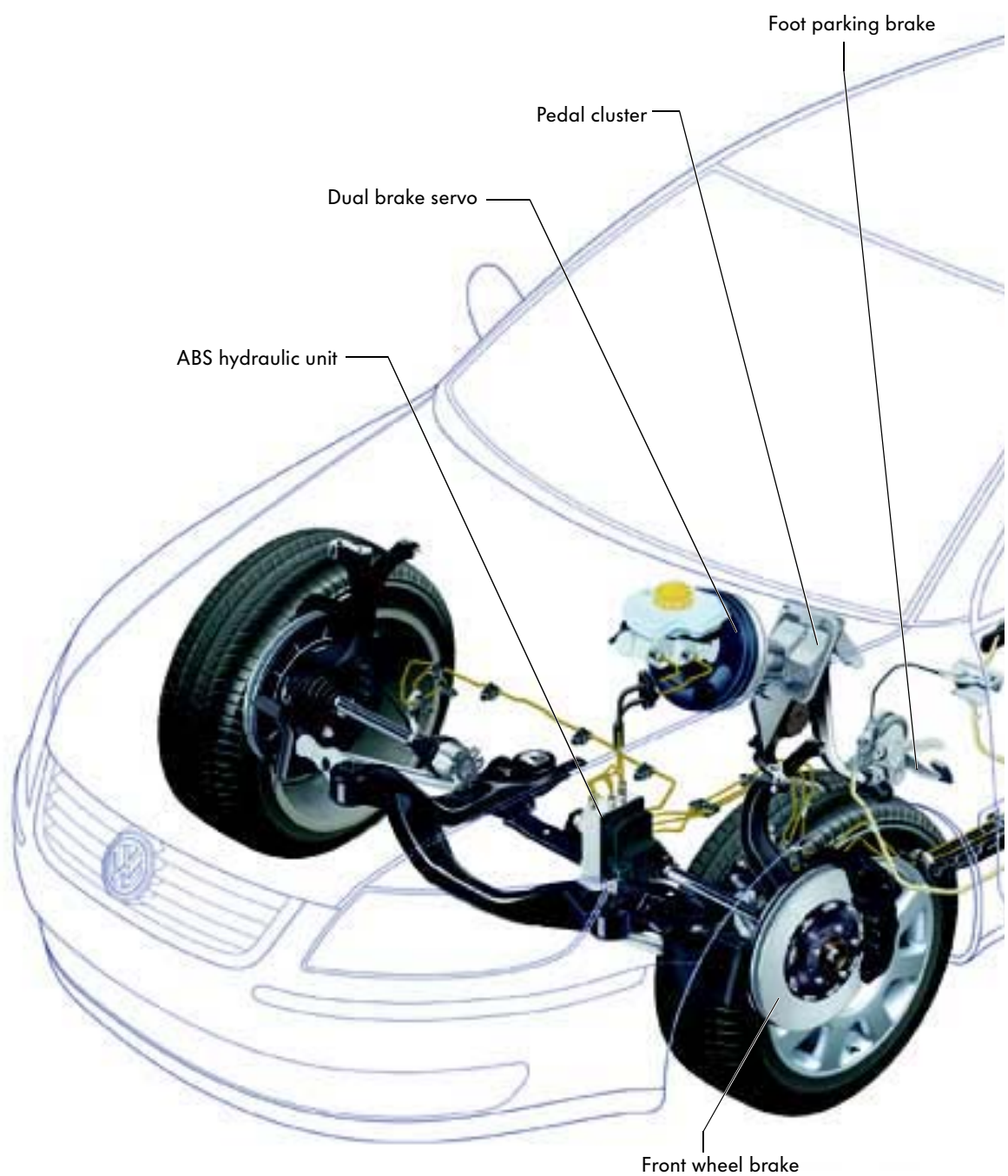
As soon as the reaction pressure, which is determined specifically for the vehicle, is reached, the cut-off valve opens and the oil flows out into the return chamber so that the pressure does not increase further. The application moment at the steering wheel now does not increase further, and conveys a secure driving feel through optimum contact with the roadway.



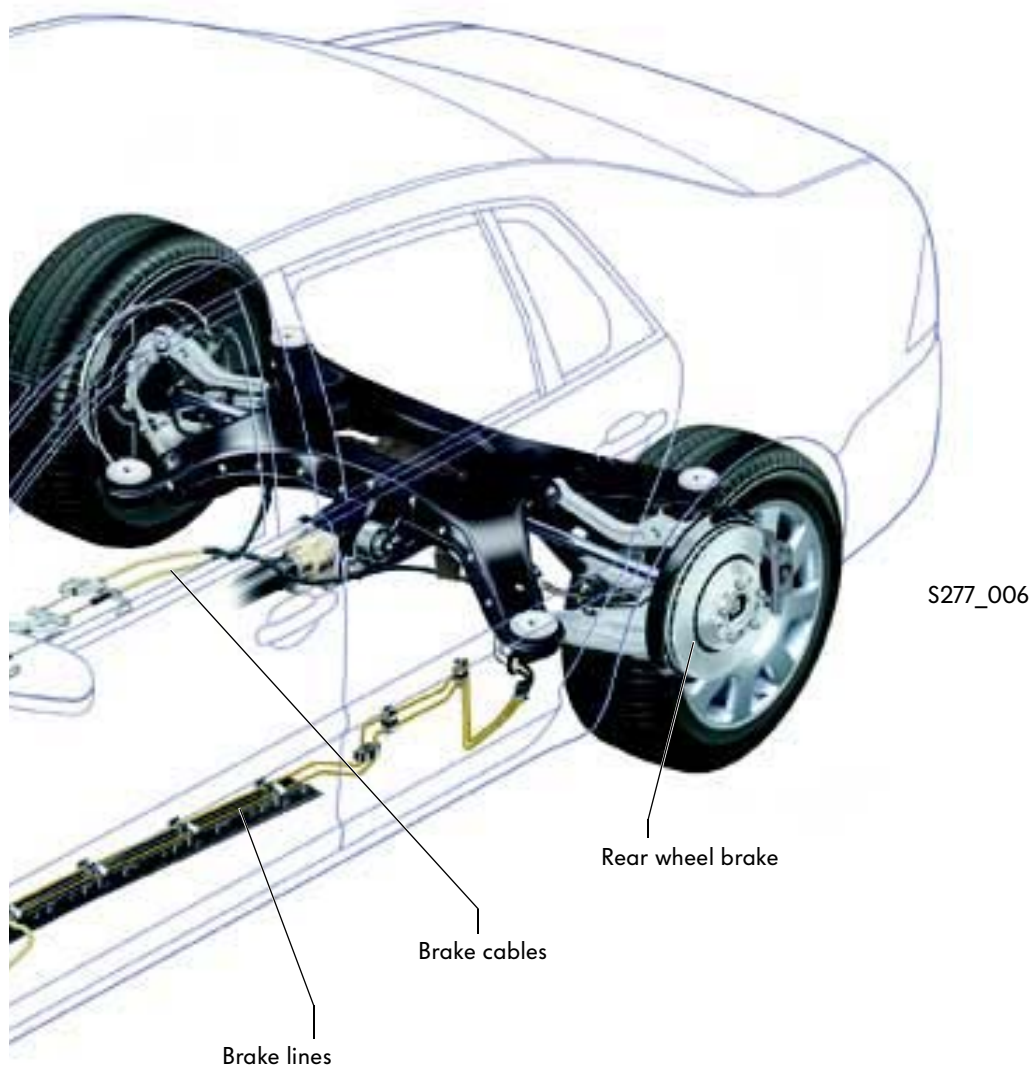
Brake system

The brake system

The Phaeton's high performance brake system consists of newly developed front and rear wheel brakes.



The brake system is fitted with the Bosch ABS System 5.7 with integrated ESP as standard.
It is diagonally separated into 2 circuits. The Phaeton has large ventilated brake discs front and rear.



Brake system

The brake equipment (all brake parts are made of aluminium)

Engine	Front	Rear
V6	Ø 323 mm x 30 mm	Ø 280 mm x 22 mm
V8	Ø 360 mm x 34 mm	Ø 310 mm x 22 mm
V10 TDI, W12	Ø 365 mm x 34 mm	Ø 335 mm x 22 mm

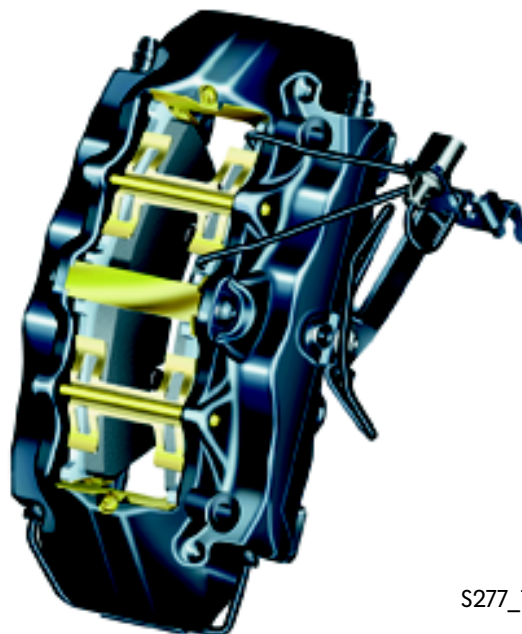
The wheel brakes

To satisfy demanding safety requirements and guarantee a high level of comfort, the wheel brakes have been specially designed for the Phaeton.

The front wheel brakes

A new aluminium brake calliper was developed for the Phaeton's 18" front wheel brake. This light-weight brake calliper consists of an unseparated housing in a monoblock design with 8 pistons and 4 brake pads.

This arrangement ensures optimum conditions for pressing the brake pads onto the brake disc. The brake calliper design, which has a wide reach around the friction ring, achieves a low weight combined with optimal calliper stiffness.



S277_103

The front brake disc

The front brake disc is constructed from two parts. The friction ring is attached to the brake disc cup with sliders.

The design allows the brake disc to freely expand radially.

This significantly improves the thermal shock resistance, that is, it increases the life of the brake disc. At the same time, this type of connection has a favourable effect on the deformation of the friction ring under temperature loading. Thus, the noise behaviour is also improved.

A positive spin-off of this design is the weight saved by manufacturing the cup from aluminium. The specially formed cooling ribs provide a robust construction with optimal flow-through. Specially shaped rims and an air guide part guide the air stream directly to the brake disc.



The rear wheel brakes

The Phaeton's rear wheel brakes are high-performance, ventilated disc brakes. The brakes use a newly developed aluminium brake calliper. The parking brake feature is integrated into the brake calliper.



Brake system

Actuation of the rear wheel brakes

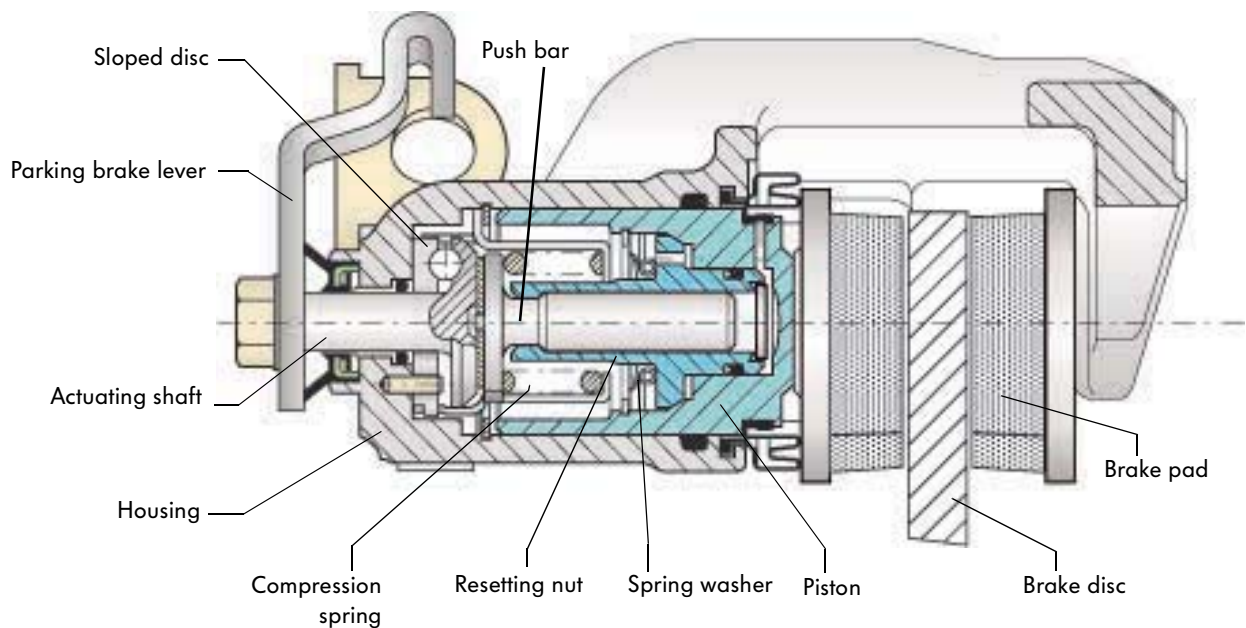
When the driver applies the hand brake, the brake cables actuate the parking brake lever on the brake calliper. The actuating shaft turns and performs a stroke.

The mounting of the actuating shaft on three balls, which are positioned on a sloped disc, produces the stroke. The stroke movement actuates the piston which clamps the brake calliper and presses the brake pads against the brake disc.

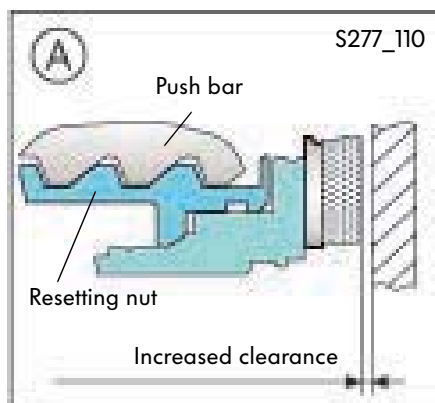
Automatic resetting

To retain the mechanical and hydraulic function of the brakes in this system, the increase in clearance that results from brake pad wear must be compensated by resetting.

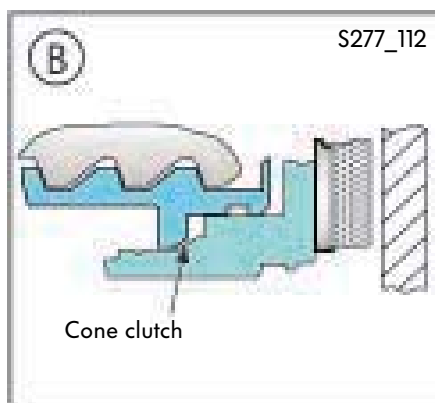
A turning action of the resetting nut on the thread of the push bar resets the clearance increase that results from brake pad wear.



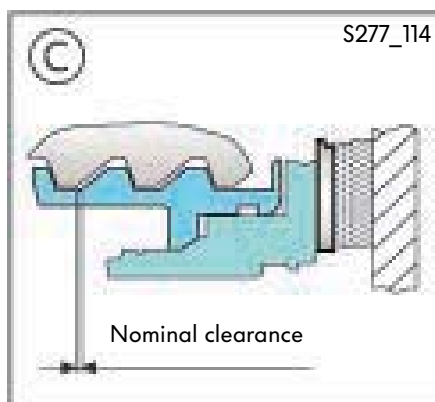
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When the driver applies the brakes and hydraulic pressure develops in the brake system and brake callipers, the piston moves in the housing towards the brake disc. The resetting nut is carried in the piston by a spring washer. If the clearance increases due to brake pad wear, it is compensated in the thread between the push bar and resetting nut. The force of the compression spring on the resetting nut acts against the pressing direction of the piston. This opens the cone clutch between the resetting nut and the piston (figures A and B).

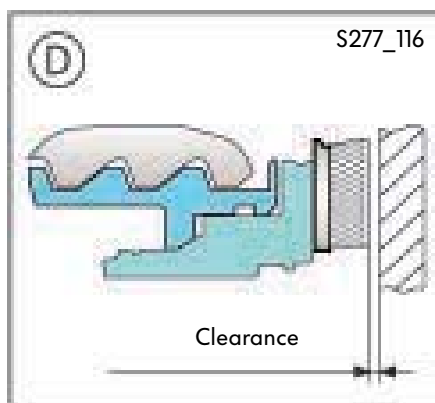


The push bar is held by the compression spring; the turns of the thread between the push bar and resetting nut are engaged in this resetting sequence. The coarse-pitch thread between the push bar and resetting nut produces a turning moment on the resetting nut.



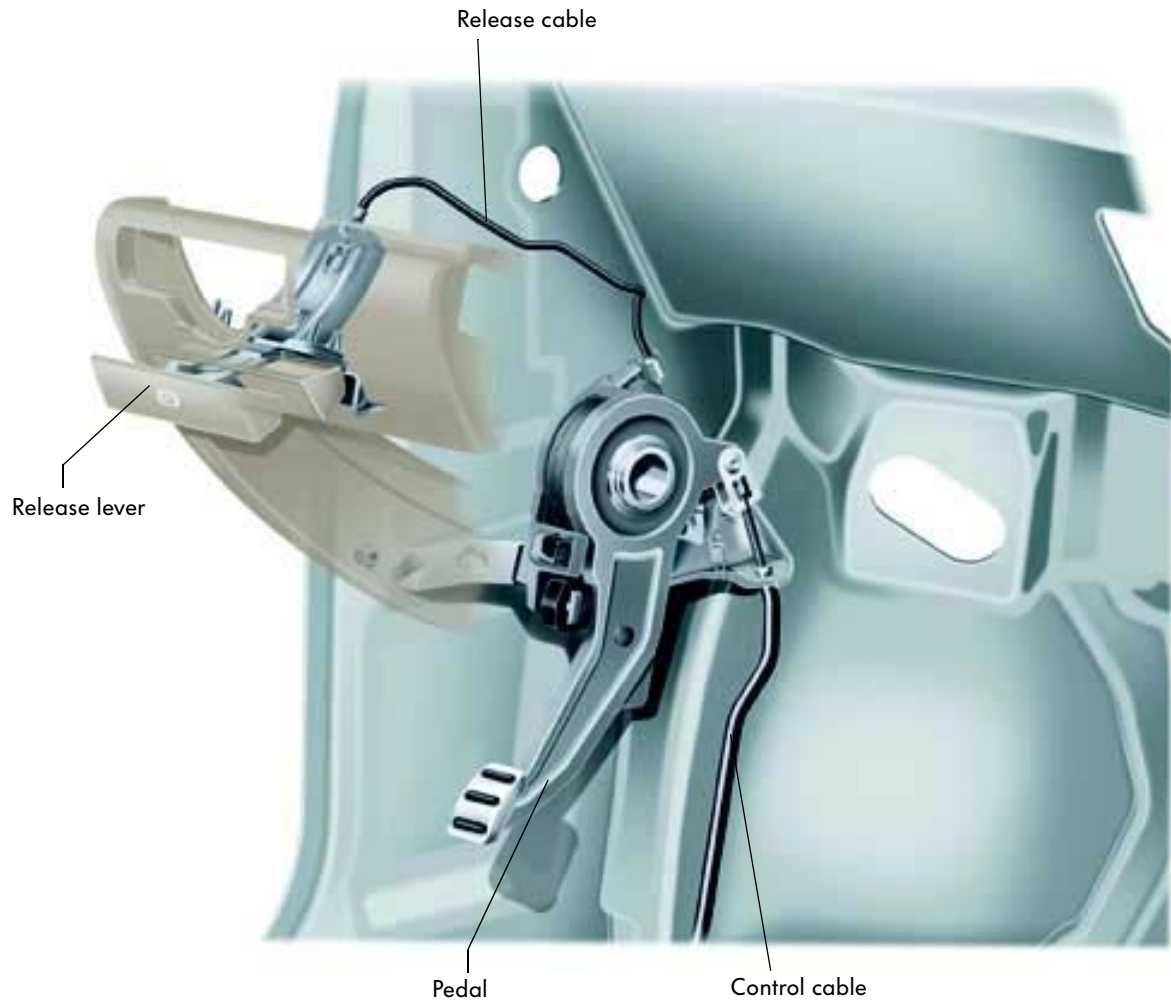
The cone clutch between the resetting nut and the piston opens far enough so that the resetting nut can turn on the thread of the push bar by the amount of the increased clearance in the brake application direction. This resetting process takes place also when the brake calliper is relieved, that is, after the braking process. Thus the brake wear that occurs while braking is directly and non-incrementally reset. After the brake calliper is relieved, a clearance between the brake pads and brake disc appears (figure D).

The nominal clearance is the play between the resetting nut and push bar thread determined by tolerances (figure C).



Brake system

The foot parking brake

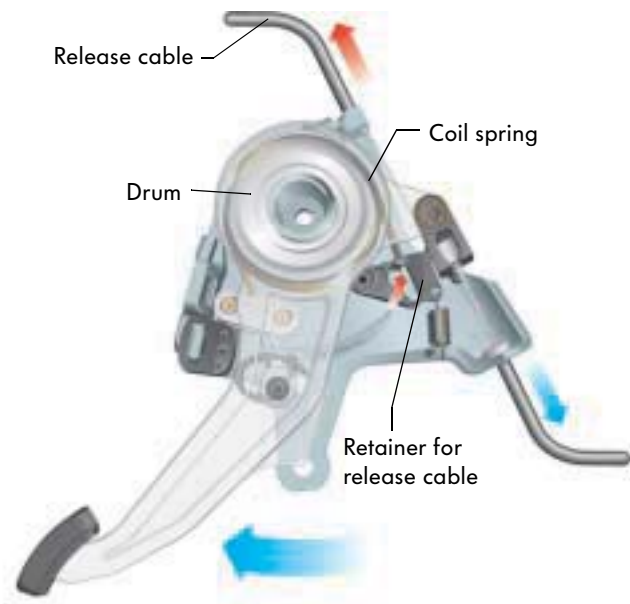
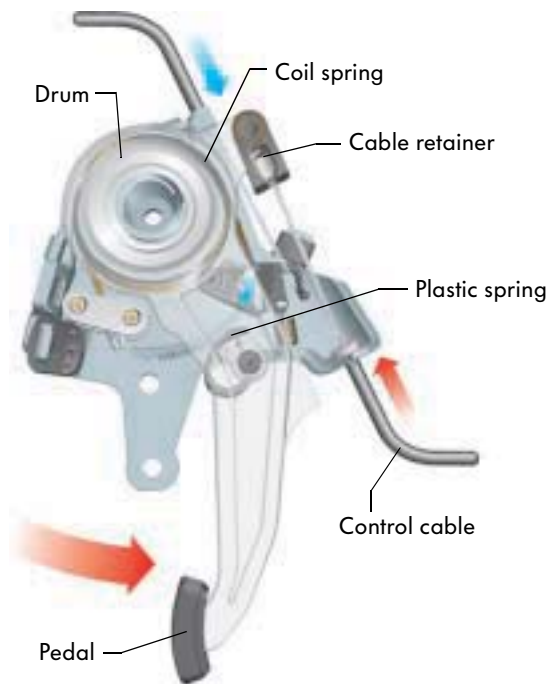


For the first time, Volkswagen has introduced in the Phaeton a foot parking brake, distinguished by its low weight, minimum release force and responsive design. The pedal cluster is manufactured from aluminium alloy.

The parking brake is located in the left of the footwell above the foot rest. The parking brake is applied by pressing the pedal.

When the driver presses the foot parking brake pedal, a control cable transfers the applied force to a lever mechanism under the floor of the vehicle. Here, the force is divided over two brake cables, which operate the actuating mechanisms on the rear wheel brakes.

The parking brake is released by pulling the release lever below the light rotary switch by hand.



S277_156

The coil spring, which acts on a drum, takes on the brake locking function. The spring slides on the drum and expands due to the direction of movement. If the counter force of the brake moves the spring in the other direction, it pulls together and increases the friction between the coil spring and drum. Thus, the pedal locking action is almost completely stepless and noiseless.

An additional plastic spring produces the typical click sound when the pedal is pressed.

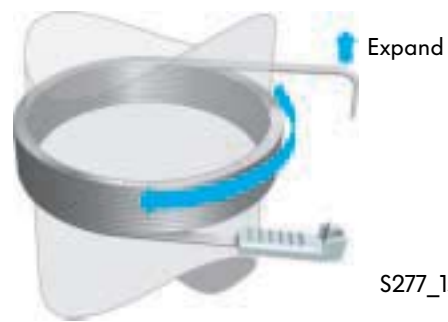
When the driver pulls the release lever, the retainer of the release cable is drawn upwards. This expands the coil spring, or in other words, the spring becomes moveable and the pedal can return to the initial position. This principle requires low release forces.



S277_152

Lock:

The coil spring presses against the drum when the pedal moves in the opposing direction.



S277_154

Release:

The diameter of the coil spring becomes larger when the spring expands. The coil spring can move on the drum.

Brake system

The brake lines and brake cables

The brake line system connects the hydraulic components of the brake system. The brake lines consist of galvanised steel pipes, which have a resistant surface protection provided by the zinc plating and an additional polyamide coating.

These lines are attached to the body with plastic holders.

A robust, hard outer shell is used for attachment. Injected, soft elements are used for noise insulation.

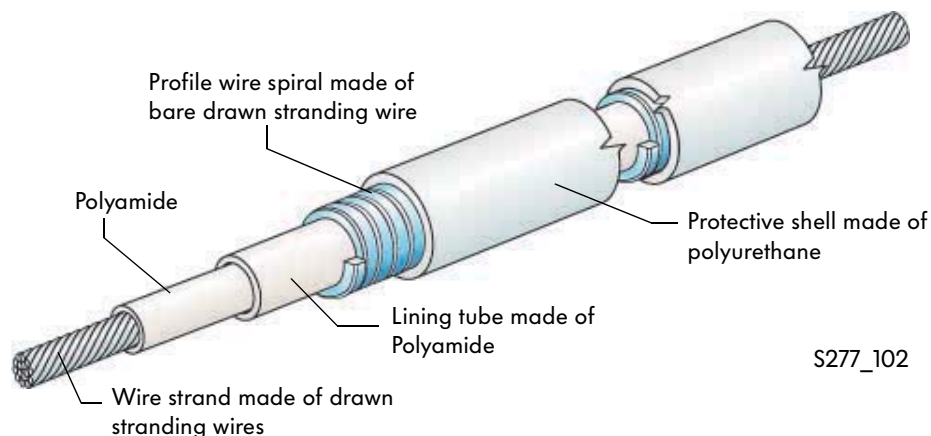
The moveable connections in the lines to the front and rear axles are brake tubes. The inner tube consists of a material that keeps water absorption into the brake fluid low. For stabilisation, this tube has several braided fibre sleeves, which are protected against external influences by CR rubber.

The lines in the engine compartment as well as those in the connection lines between the ESP unit and the brake servo are connected to plastic tubes with braided steel sheathing. The structure of these lines also reduces noise transfer from the unit during operation.



The hand brake cable

Structure of the hand brake cable



S277_102

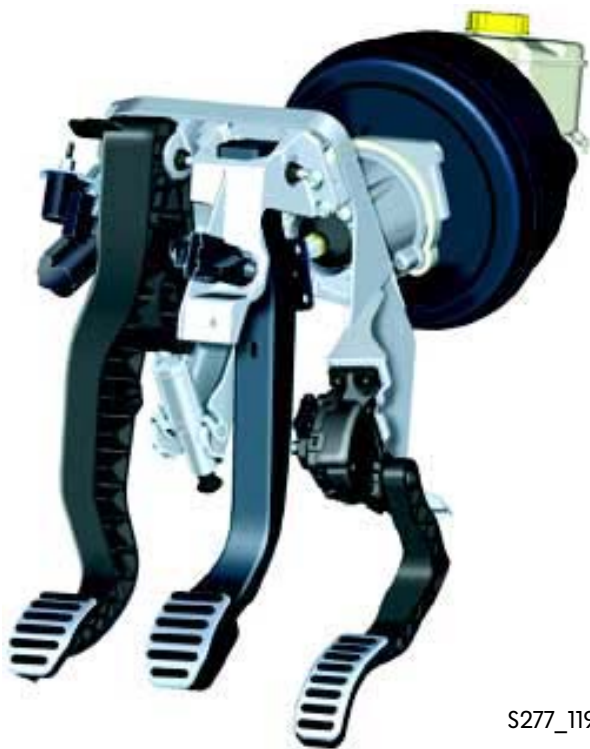
The brake cables are sheathed in polyamide and greased to prevent corrosion and reduce friction forces.

The pedal cluster

The bearing block of the pedal cluster is made of aluminium alloy. It is designed to break at a specific location in the event of a crash. Thus the driver's lower legs and feet are not endangered.

To upgrade the aesthetics, additional custom covers are fitted to the pedals.

Pedal cluster - manual transmission



S277_119

Pedal cluster - automatic transmission



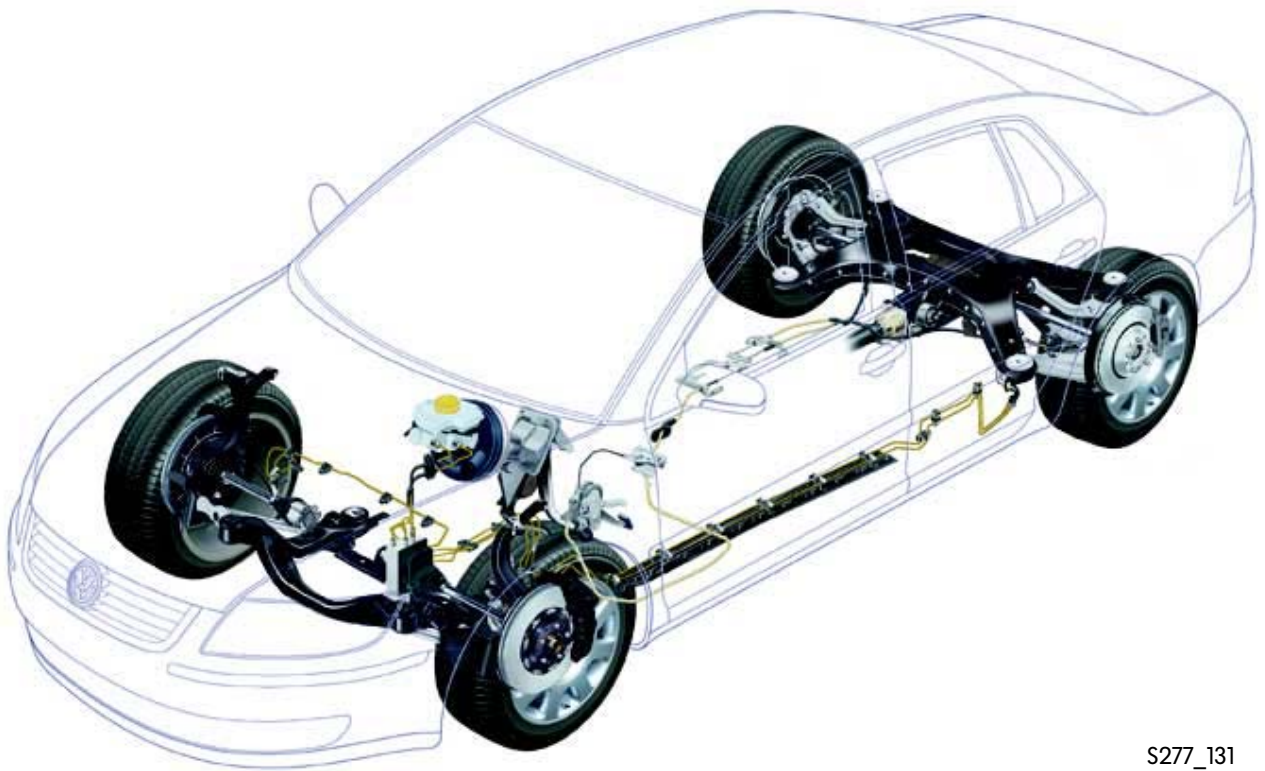
S277_117



Brake system

The Bosch 5.7 ABS / ESP anti-lock braking system

The Phaeton uses the Bosch 5.7 ABS system with ESP (electronic stability program) with hydraulic braking assistant.



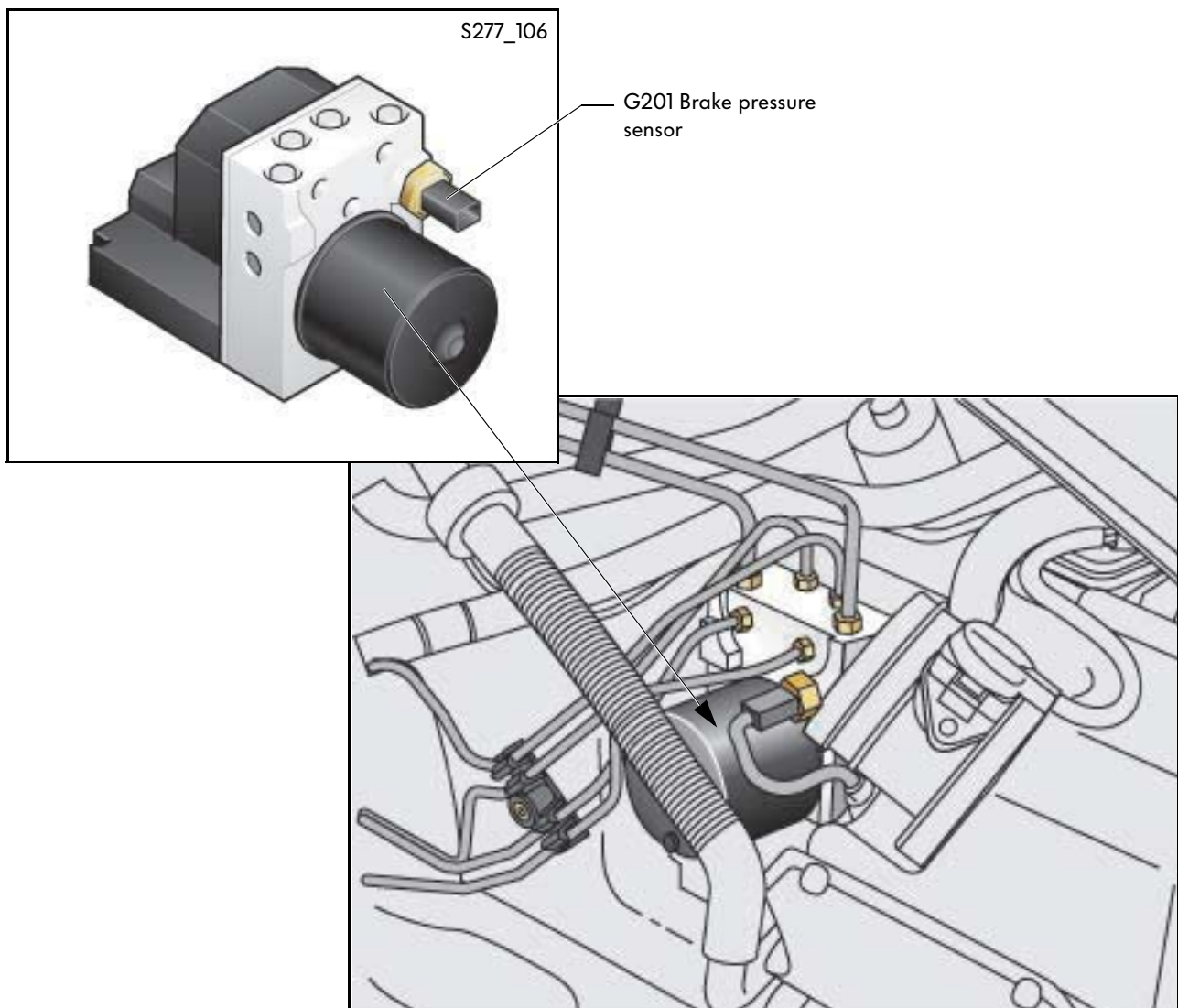
S277_131



The special characteristics of the Bosch 5.7 ABS system include:

- The hydraulic unit and control unit are integrated into one unit.
- The G201 brake pressure sensor screws directly into the hydraulic unit.
- An ESP feature without preloading is provided.
- The ESP has EDL, TCS and ABS features as well as a braking assistant.
- Even when the active ESP function is switched off, the vehicle remains stable in critical situations due to the application of ESP logic ("passive" ESP).

Control unit with hydraulic unit



Brake system

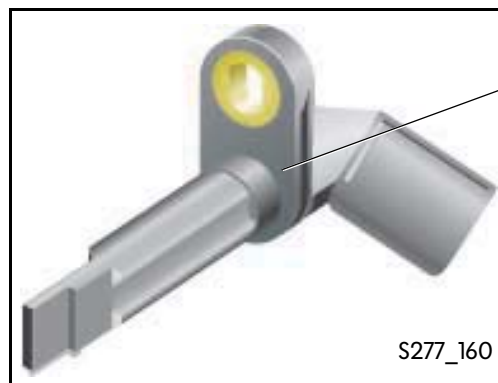
The active wheel sensor system

The speed sensor is made of a material that changes its electrical conductivity depending on a magnetic field.

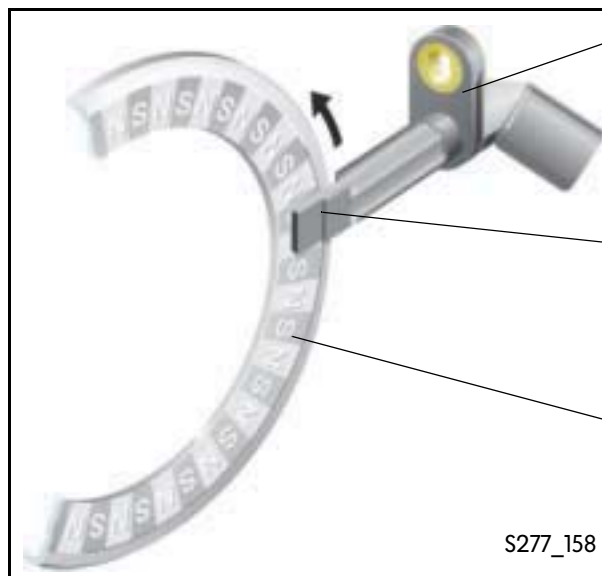
An electronic switch converts the current fluctuations induced in the sensor material into voltage fluctuations at the sensor output.

If the signal wheel moves relative to the sensor, the sensor generates a square-wave voltage signal at the corresponding frequency depending on the speed of rotation.

The advantage compared to previously used systems is that it is possible to exactly detect the speed of wheel rotation right down to zero rotation.



Speed sensor



Sensor housing

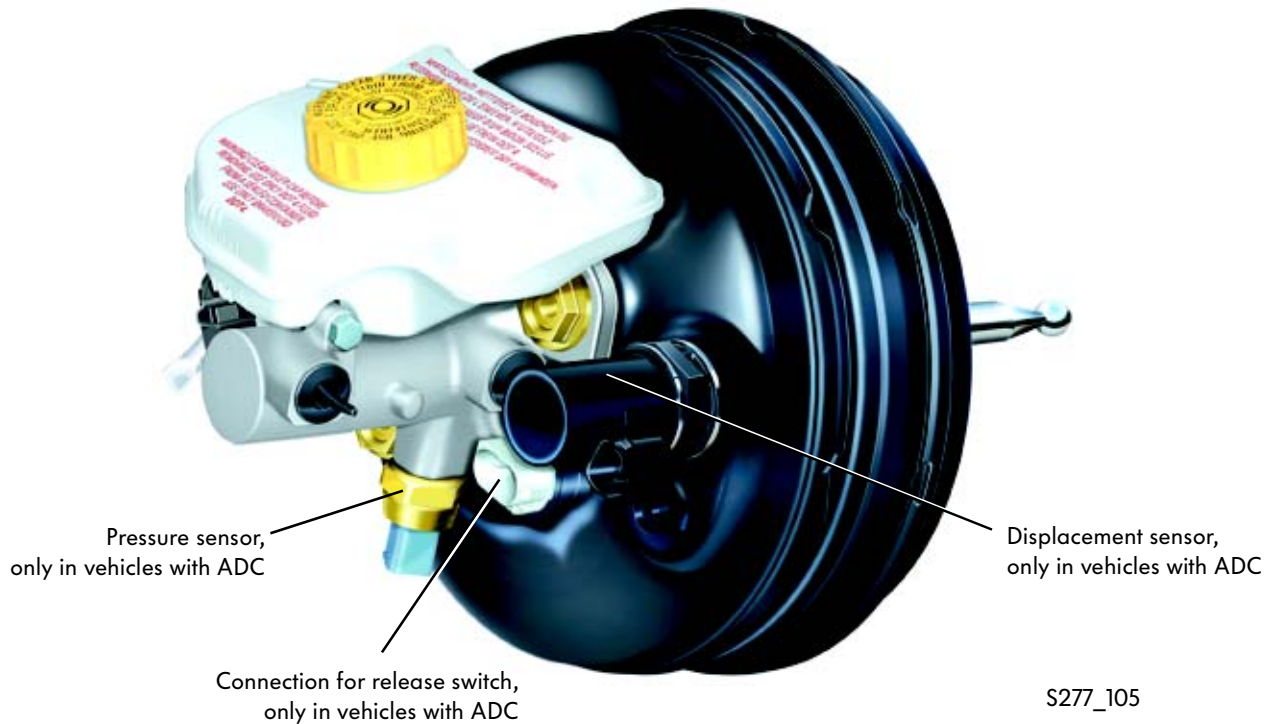
Sensor electronics

Signal wheel



For more information on the active wheel sensor system, please see SSP 218 “The Lupo 3L TDI”.

The dual brake servo



The brake servo is an 8/9" dual brake servo with a stroke of 36 mm.

The diameter of the main brake cylinder is 26.99 mm.

The dual brake servo has a light-weight construction and has the following features:

- The central valves of the dual main brake cylinder guarantee the shortest application distance at the pedal combined with reliable, self-priming ESP functionality.
- The active (electrically activated) brake servo variant represents the core component for activation with automatic delay of the vehicle in ADC operation (automatic distance control) and guarantees regulated, automatic delay.



Vehicles with ADC have an active brake servo.

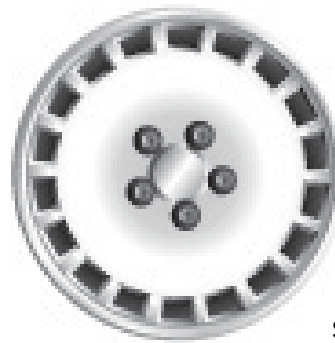
For more information, please see SSP 276 "Automatic distance control".

Wheels and tyres

The wheels and tyres

The Phaeton sets standards in comfort and driving dynamics. Different wheel-tyre combinations are available with the Phaeton.

Vehicles with V6 petrol engines are equipped with cast aluminium wheels with dimensions 7½ J 16 ET40 and 235/60R16 tyres as standard.



S277_045

Vehicles with W12 petrol engines have 18" cast aluminium wheels with dimensions 7½ J 18 ET40 and 235/50R18 tyres.



S277_043

One-piece cast aluminium hollow spoke wheels are also optional for all engine types. The 8½ J 18 ET45 wheel comes with a 255/45R18 tyre.



S277_041





S277_162



All normal tyres have the “Y” speed index (300 km/h) and the special designation “XL”.
(XL = EL = extra load = reinforced)

The puncture repair kit

Emergency tyre inflation



S277_039

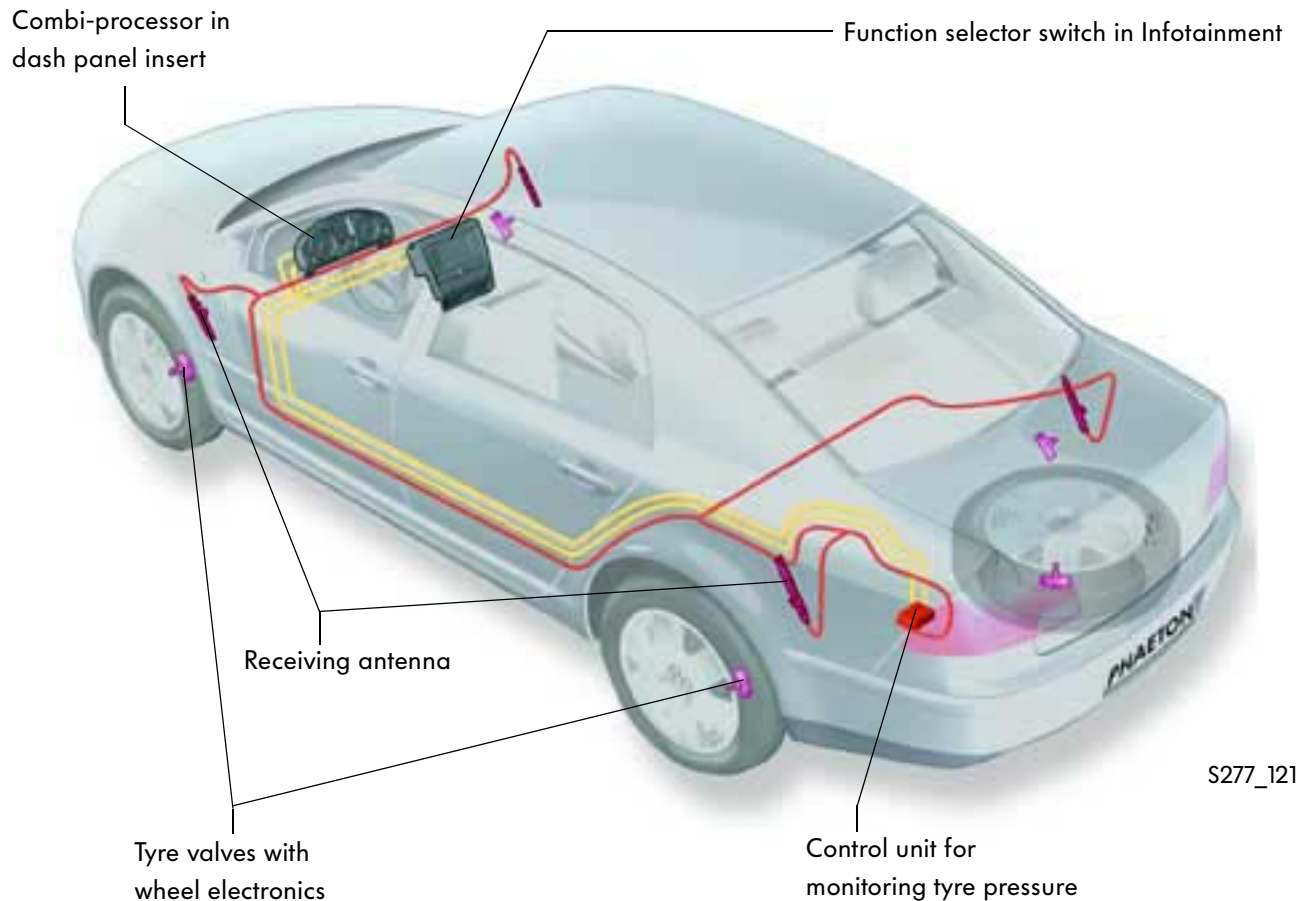
The Phaeton is equipped with puncture repair kit as standard. A complete spare wheel with tyre can be ordered instead of the puncture kit.

The chapter “Tips and Maintenance” in the operating manual describes how to use the breakdown set.



Tyre pressure monitor

Tyre pressure monitor (TPM)



Function of the tyre pressure monitor

The tyre pressure monitor continuously monitors the tyre pressure while driving and also when the vehicle is stationary.

The tyre pressure monitor used in the Phaeton is a 5-wheel system. The spare wheel is also monitored and included in the system messages.

A measuring and transmitting unit mounted in each tyre valve sends radio signals at regular intervals to the antennas mounted in each wheel housing.

The signals are then passed on to the control unit for monitoring the tyre pressure.



The control unit evaluates the tyre pressures or changes in tyre pressure and sends corresponding system messages to the dash panel insert. The system messages then appear on the driver information system display.

If the driver has selected the “Vehicle” menu in the main information display and operating unit (ZAB), the system messages for tyre pressure monitor are displayed.

The system recognises the following situations:

- Gradual pressure loss:
The system informs the driver in time to be able to correct the tyre pressure.
- Sudden pressure loss:
The system warns the driver immediately while driving.
- Excessive pressure loss when the vehicle is stationary:
The system warns the driver immediately after the ignition is switched on.

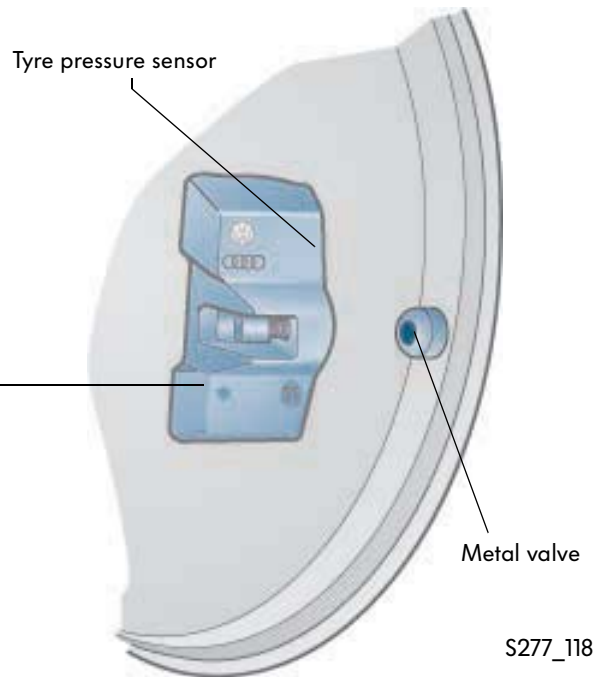
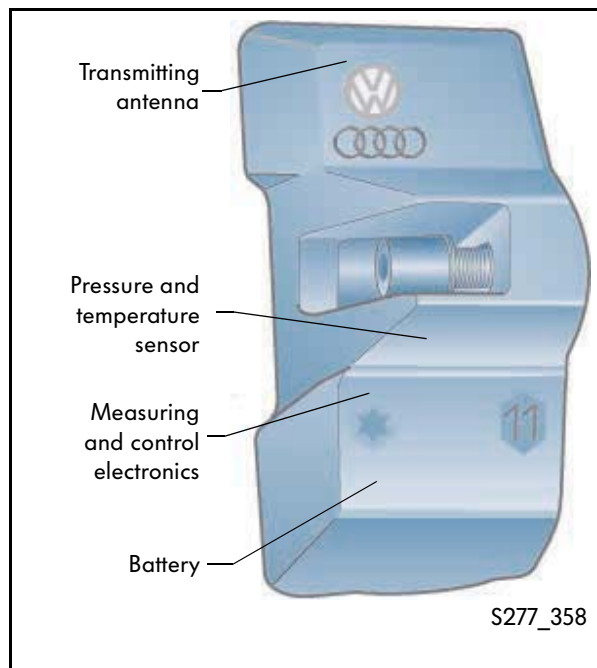


Tyre pressure monitor

The tyre pressure sensors G222...G226

The tyre pressure sensors are screwed to the metal valves and can be reused when the wheels or rims are changed.

The following components are integrated into a tyre pressure sensor:



The pressure sensor detects the actual tyre inflation pressure (absolute pressure measurement). The pressure is then sent to the tyre pressure monitoring control unit for evaluation.

The temperature signal is used for compensating temperature-dependent pressure changes in the tyres as well as for diagnostic purposes.

The control unit for monitoring the tyre pressure performs the temperature compensation. The measured tyre inflation pressures are normalised to a temperature of 20 °C.

The pressure sensor, temperature sensor and measuring and control electronics are integrated into one intelligent sensor.

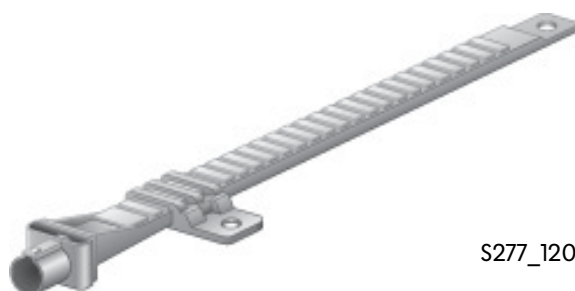
When the driver selects "Store pressures", the tyre inflation pressures are normalised to 20 °C.

To avoid making incorrect settings, pay particular attention that the tyre inflation pressures are checked or corrected and stored with "cold tyres".



The following information is sent from the transmitting antenna of the tyre pressure sensor:

- Individual identification number (ID code),
- Current tyre inflation pressure (absolute pressure),
- Current tyre air temperature,
- Condition of the integrated battery and
- The status, synchronisation and control information necessary for secure data transfer.



S277_120

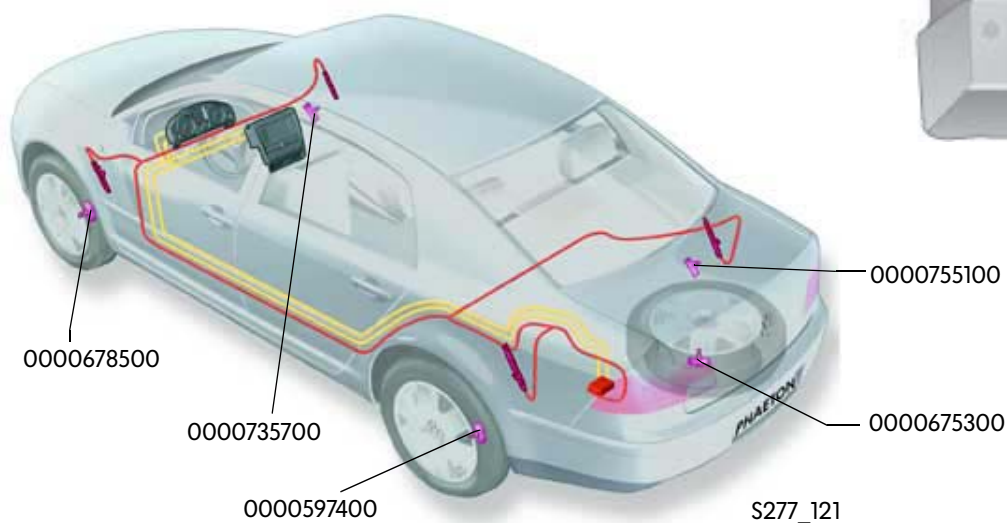


The ID codes

Each tyre pressure sensor has an individual identification number (ID code), which is used for “own wheel recognition”.



S277_122



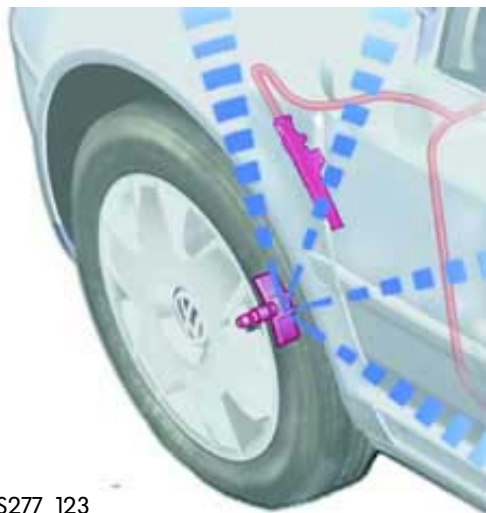
S277_121



Tyre pressure monitor

The tyre pressure monitoring antennas R59 ... R62

The antennas for monitoring the tyre pressure, R59 ... R62, are located in the wheel housings behind the wheel arch shells.



S277_123



S277_120

The antennas for monitoring the tyre pressure receive radio signals from the tyre pressure sensors and transfer these signals to the control unit for monitoring the tyre pressure for further processing.

The tyre pressure monitor has 4 antennas for monitoring tyre pressures. They are mounted in the FL, FR, RL, RR wheel housings behind the wheel arch shells.

They are connected to the control unit for monitoring the tyre pressure using high frequency antenna lines and are allocated to the control unit according to their location.

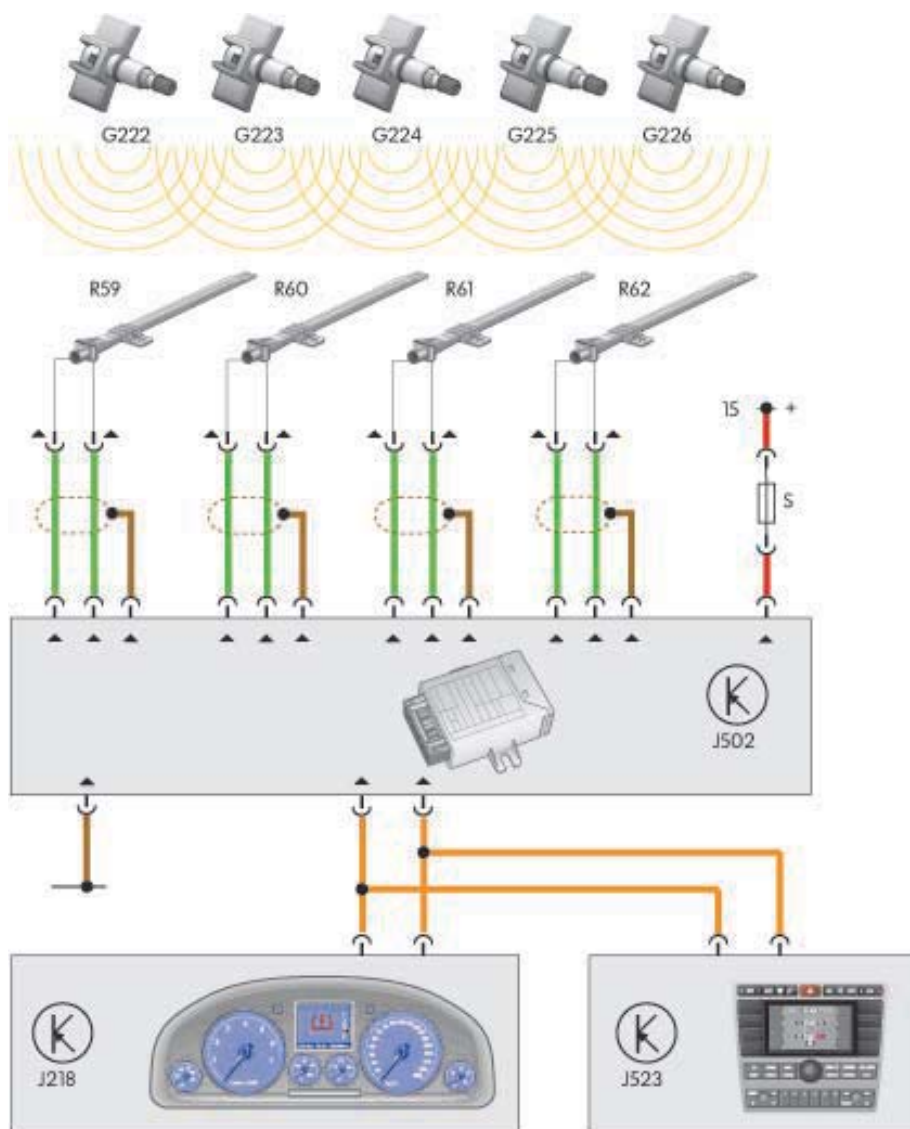
The antennas receive all radio signals transmitted in their reception and frequency range. Each antenna receives the radio signals of all wheel sensors that are in range.

The control unit filters and selects the radio signals so that it can process the correct information.



The spare wheel does not have a separate antenna assigned to it. The antennas receive the radio signals that the spare wheel transmits (data messages) and transfer the signals to the control unit for monitoring the tyre pressure. The control unit recognises and stores the “fifth wheel” as the spare wheel using own wheel and position recognition.

The system overview









S277_124

The components

G222 Front left tyre pressure sensor
 G223 Front right tyre pressure sensor
 G224 Rear left tyre pressure sensor
 G225 Rear right tyre pressure sensor
 G226 Spare wheel tyre pressure sensor
 J218 Combi-processor in dash panel insert
 J502 Control unit for monitoring the tyre pressure
 J523 Main information display and operating unit
 R59 Tyre pressure monitoring antenna, front left

R60 Tyre pressure monitoring antenna, front right
 R61 Tyre pressure monitoring antenna, rear left
 R62 Tyre pressure monitoring antenna, rear right

 = Input signal
 = Output signal
 = Positive
 = Ground
 = CAN data bus
 = Gold contact



Tyre pressure monitor

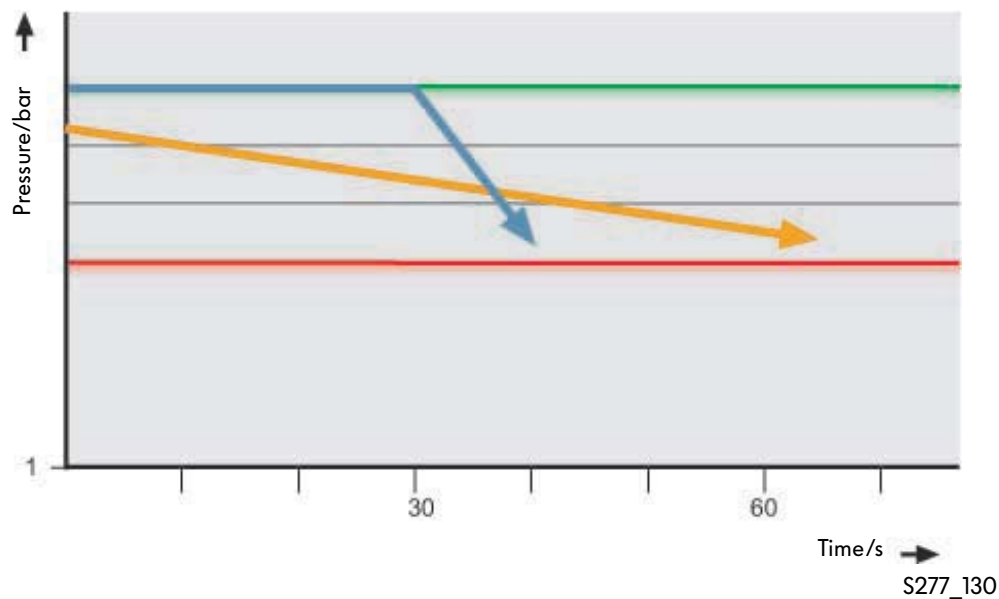
The warnings

The strong warnings

Sudden pressure loss



S277_128



The wheel electronics sends data messages every 54 seconds. If the wheel electronics detects a sudden change in pressure (>0.2 bar/min.), it transmits in 850 ms cycles.



Target tyre pressure stored via the menu.
The system calculates the target pressures relative to 20 °C from the respective inflation pressures.



Strong warning due to sudden pressure loss >0.4 bar below the stored target tyre pressure.



The pressure falls below the coded minimum pressure of, for example, 1.9 bar for W12.



Dynamic strong warning on sudden pressure loss >0.2 bar relative to the last transmitted pressure value.

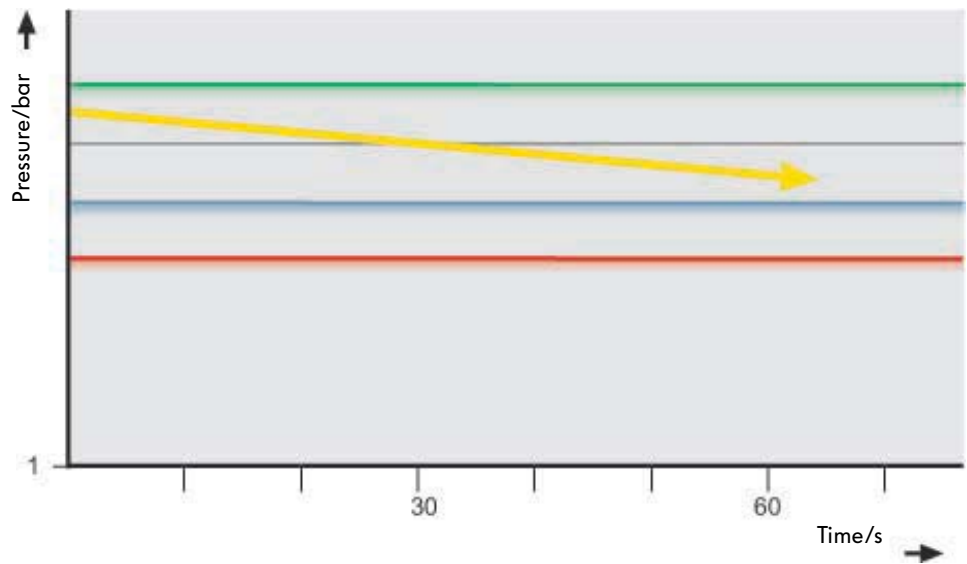


The soft warnings

Slow pressure loss



S277_140




S277_142


The wheel electronics sends data messages every 54 seconds. If the wheel electronics detects a sudden change in pressure (>0.2 bar/min.), it transmits in 850 ms cycles.



If the driver has inflated the tyres to pressures critical to driving dynamics, the system also issues warnings.

- The difference in target pressures on one axle may not exceed 0.4 bar.
- The difference in target pressures between the axles may not exceed 0.5 bar.

 Soft warning due to pressure loss between 0.2 and 0.4 bar below the stored target tyre pressure.

 Strong warning due to pressure loss >0.4 bar below the stored target tyre pressure.

If the spare tyre pressure falls below its stored target pressure by more than 0.4 bar, a soft warning likewise appears.



Tyre pressure monitor

The warnings in the dash panel insert (centre display)

The small symbol is always displayed.

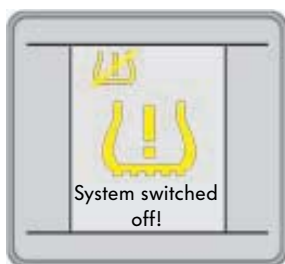
The large symbol only appears when the "Tyre pressure monitor" menu is open.

It disappears when another menu opens.



S277_146

... Display during the learn phase



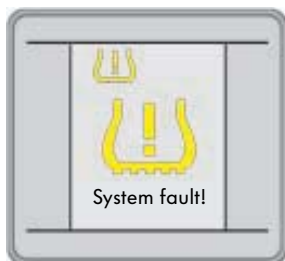
S277_146

... Display when switching off



S277_146

... Display during radio fault



S277_148

... Display during system fault



S277_148

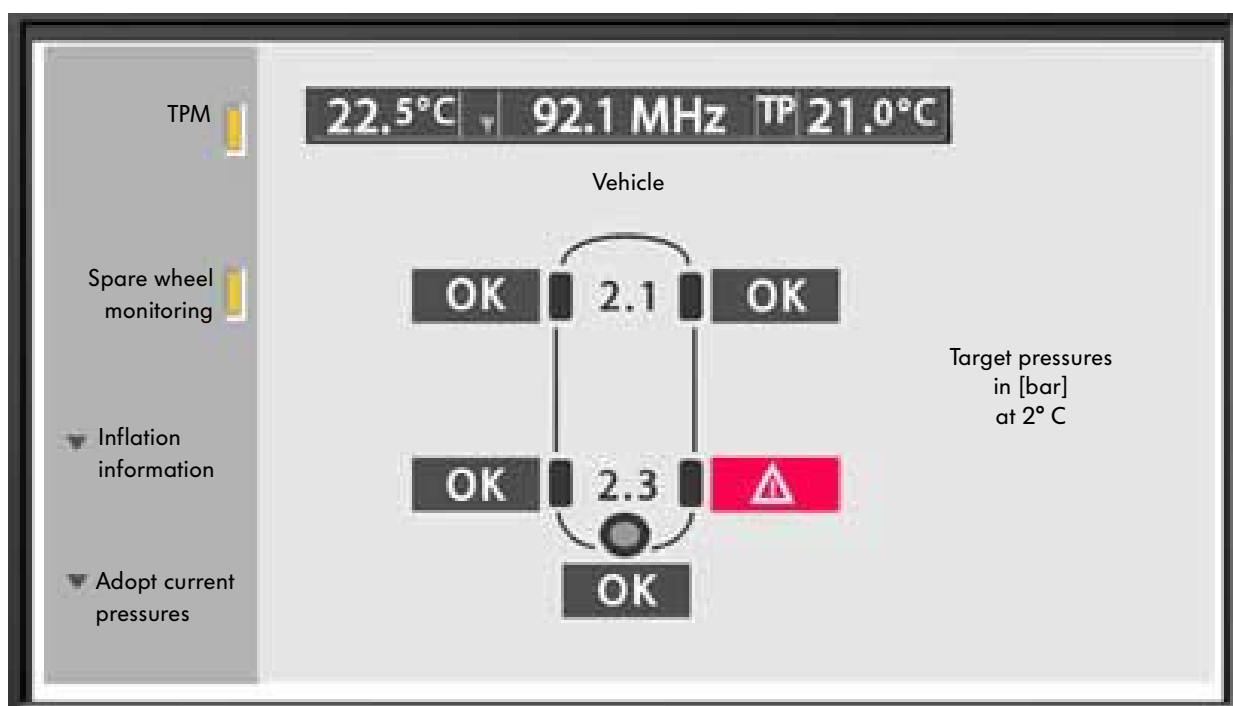
... Display when faulty wheel on board



The controls

"Vehicle"
function key

S277_150



Tyre pressure monitor main menu with strong warning rear right

S277_127



The driver is responsible for correctly setting the tyre pressures to be monitored.

Tyre pressure monitor

The tyre pressure monitor system main menu appears in the main information display and operating unit (ZAB) display when the “Vehicle” function key is pressed.

The following functions are stored

- Switch on/off tyre pressure monitor system
- Switch on/off spare wheel monitoring
- Inflation info
- Adopt current pressures

The driver can specify and set the tyre pressures to be monitored within the limits coded according to the vehicle series.

After pressing the “Adopt current tyre pressures” function key and then confirming the pressures, the system stores the current tyre inflation pressures at the current tyre inner temperatures for the respective IDs.

Pressing the key also starts a new learn process for wheel assignment. To avoid receiving from external wheel electronics while learning, the system learns only when travelling faster than 5 km/h. The learning process is complete after about 15 minutes driving time.



Check Your Knowledge

1. What is special about the Phaeton's wheel bearings?

- ☐ a. They are bolted to the wheel bearing housing as one unit.
- ☐ b. They are joined to the wheel bearing housing by optimal pressing.
- ☐ c. They can be installed without removing the pivot bearing or jointed shaft.

2. Which components have advantageous effects on the scrub radius and the road feedback lever arm?

- ☐ a. The light-weight brake calliper, which consists of an unseparated housing in a monoblock design with 8 pistons and 4 brake pads.
- ☐ b. The electronically controlled and speed dependent Servotronic system.
- ☐ c. The virtual steering axis.

3. Where is the antenna that receives the data messages from the tyre pressure sensor in the spare wheel?

- ☐ a. In the boot.
- ☐ b. In the centre console between the driver and front passenger.
- ☐ c. The spare wheel does not have its own antenna; the other antennas receive the signals from the spare wheel sensor and identify the sensor using its unmistakable ID code.





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