

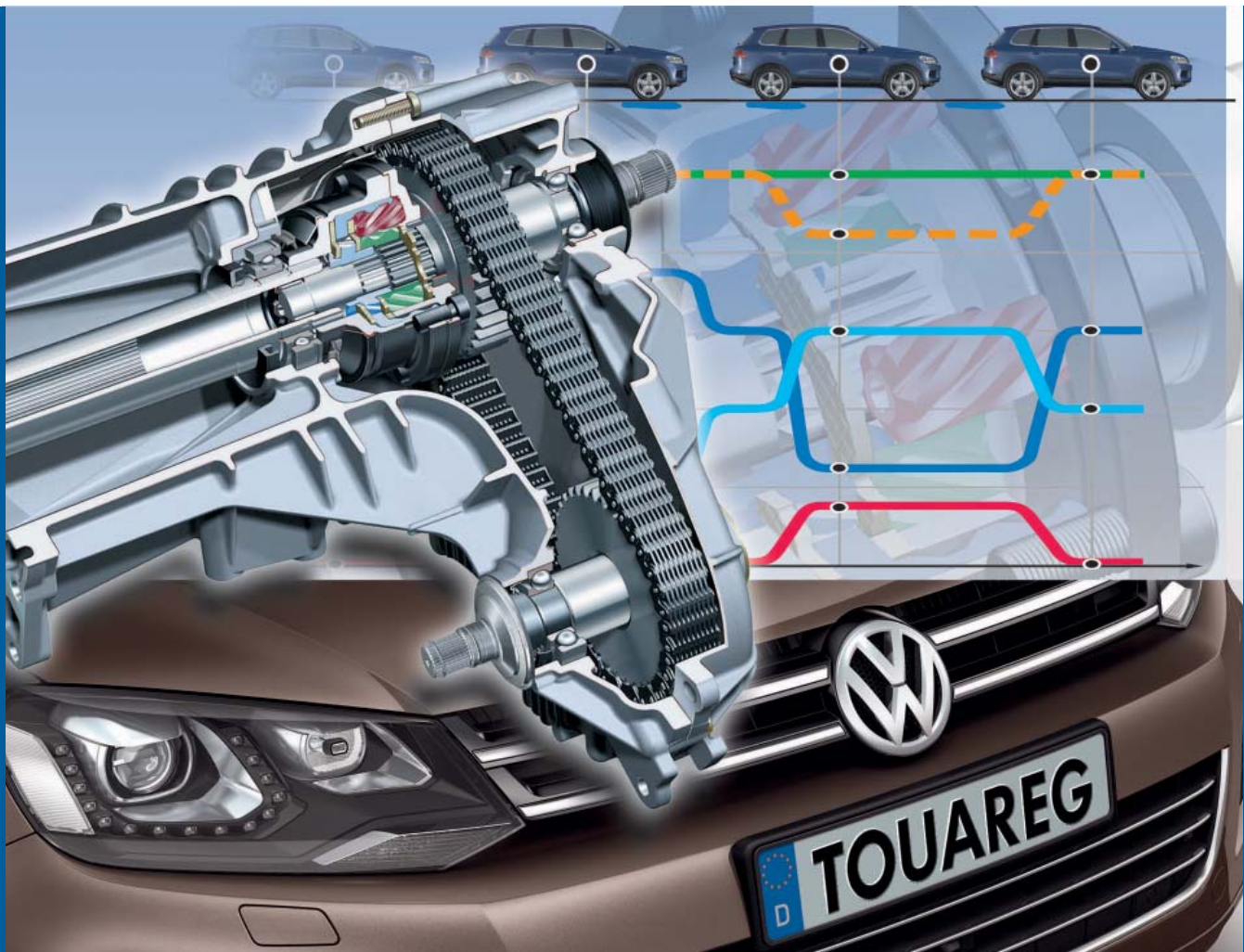


Self Study Program 860133

The 2011 Touareg

Chassis and Four-wheel Drive Concept

Design and Function



Volkswagen Group of America, Inc.
Volkswagen Academy
Printed in U.S.A.
Printed 3/2013

Course Number 860133

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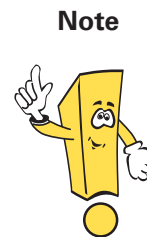
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Contents

Introduction	1
Front and Rear Axle	6
Braking System	8
Steering	20
Hybrid Electrical Components	25
Wheels and Tires	27
Tire Pressure Monitor	28
Transfer Case	30
Knowledge Assessment	43

This Self-Study Program provides information regarding the design and function of new models. This Self-Study Program is not a Repair Manual.

This information will not be updated. For maintenance and repair procedures, always refer to the latest electronic service information.





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Introduction

The 2011 Touareg is a completely new vehicle. It combines the sporty performance of a car with improved off-road capabilities.

The chassis has been revised not just to improve the performance, but also to reduce the weight of components. It is also up to 103 lb (46.7 kg) lighter than the previous model, reducing fuel consumption and carbon dioxide emissions.



S469_001

Introduction

2011 Touareg Chassis

The 2011 Touareg offers outstanding on and off-road qualities thanks to its revised suspension. The running gear has the following characteristics:

- Very good vibration and wheel/tire comfort
- Low rolling resistance
- Agile performance
- High stability
- Very good off-road capabilities

- Leather or Wood Steering Wheel, with Multifunction Buttons Available

- ABS/ESC MK25 A-XT from Conti Teves

- Front and Rear Anti-Roll Bars

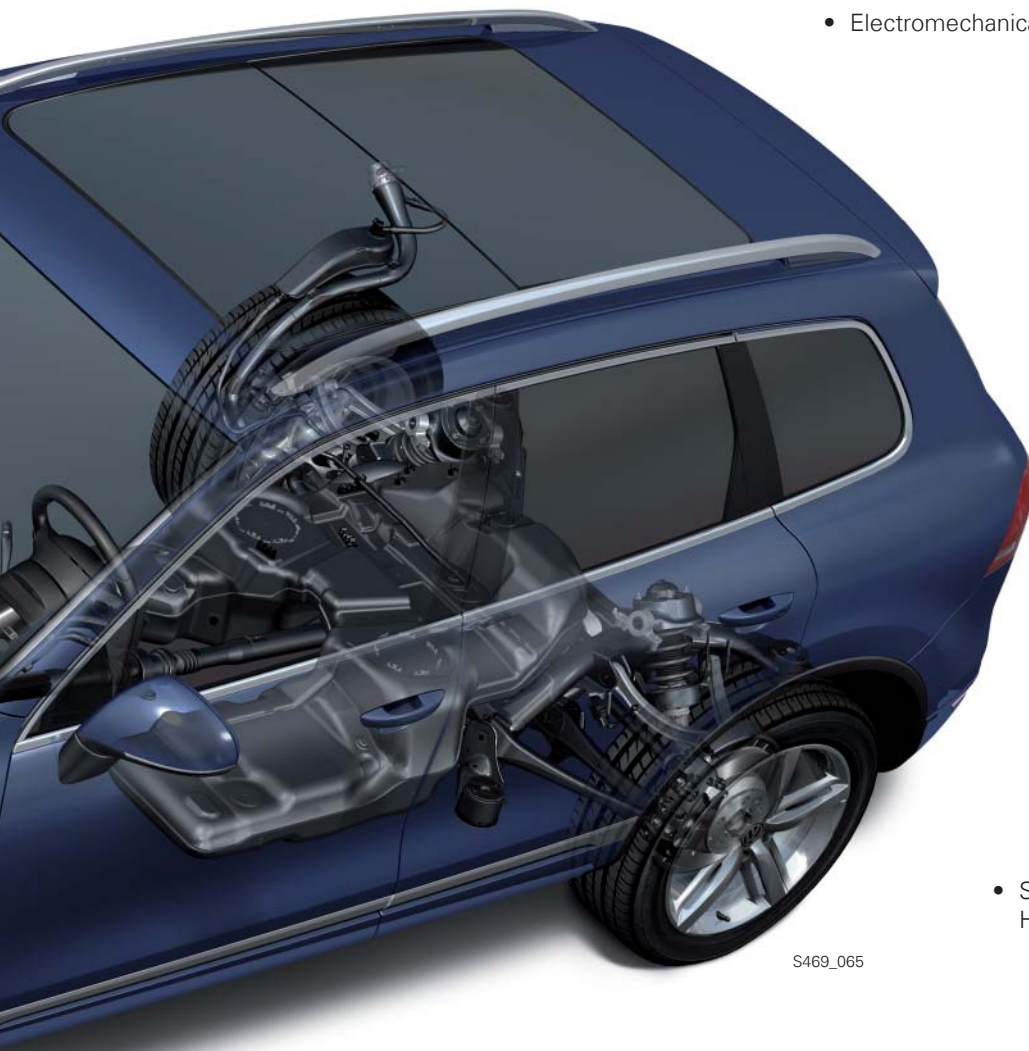
- Independent Suspension

- Tire Pressure Monitoring

- Front and Rear Vented Disc Brakes



Introduction



- Electromechanical Parking Brake

- 4MOTION with Transfer Case

- Double Wishbone Rear Suspension with Split Upper Wishbone

- Stationary Vehicle Management with HILL HOLD and AUTO HOLD

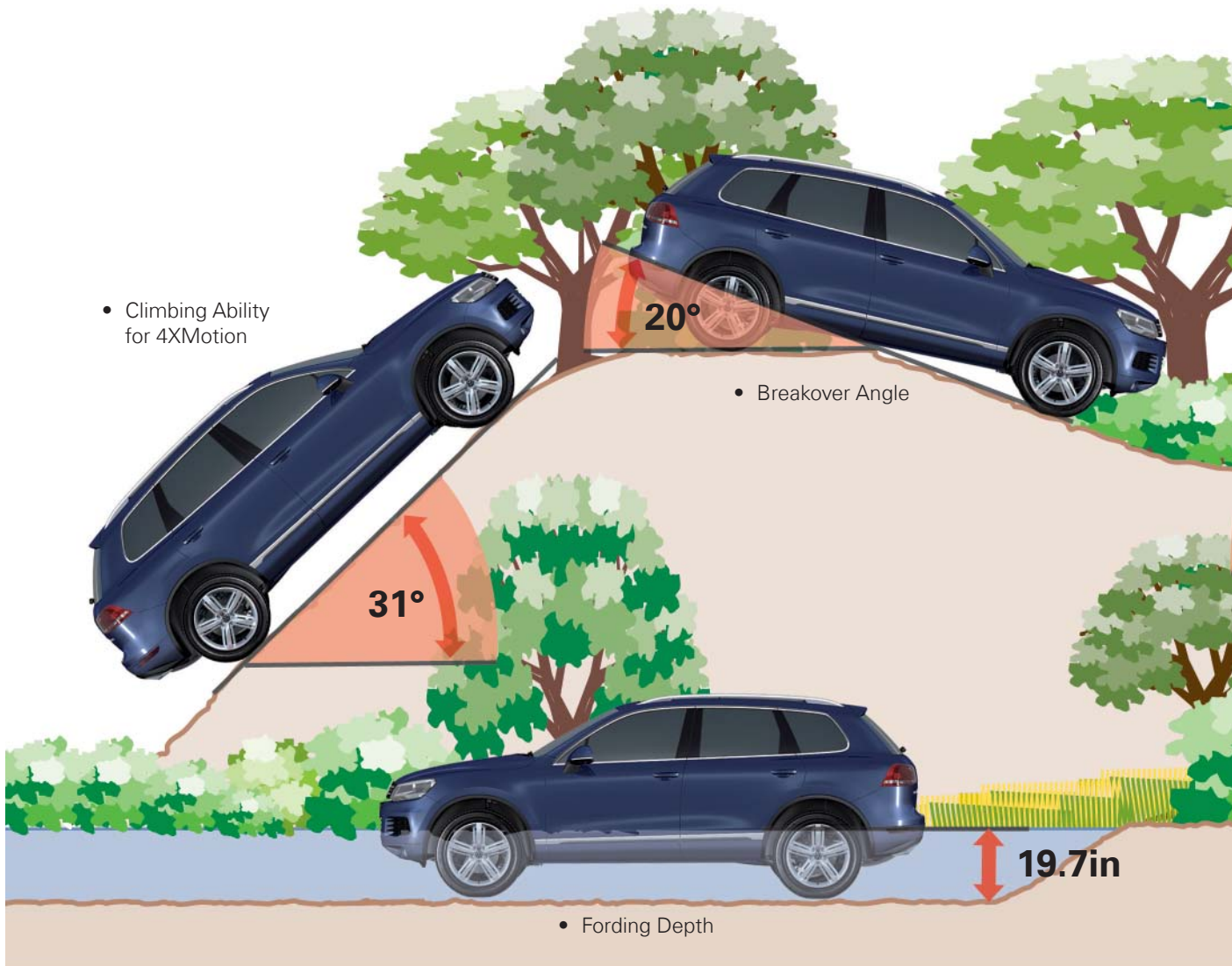
S469_065

Introduction

Four-Wheel Drive Concept

The Touareg has excellent off-road capability due to:

- Short body overhangs
- Climbing ability of 31° with 4MOTION
- A lateral inclination of 35 degrees
- The breakover angle and the axle articulation also make extreme off-road usage possible.



Introduction

Values for vehicles with steel suspension:

- Fording depth = 19.7 in (500 mm)
- Ground clearance = 8.5 in (205 mm)
- Breakover angle = 20°



The climbing ability for vehicles with transfer case is 31° (4MOTION).

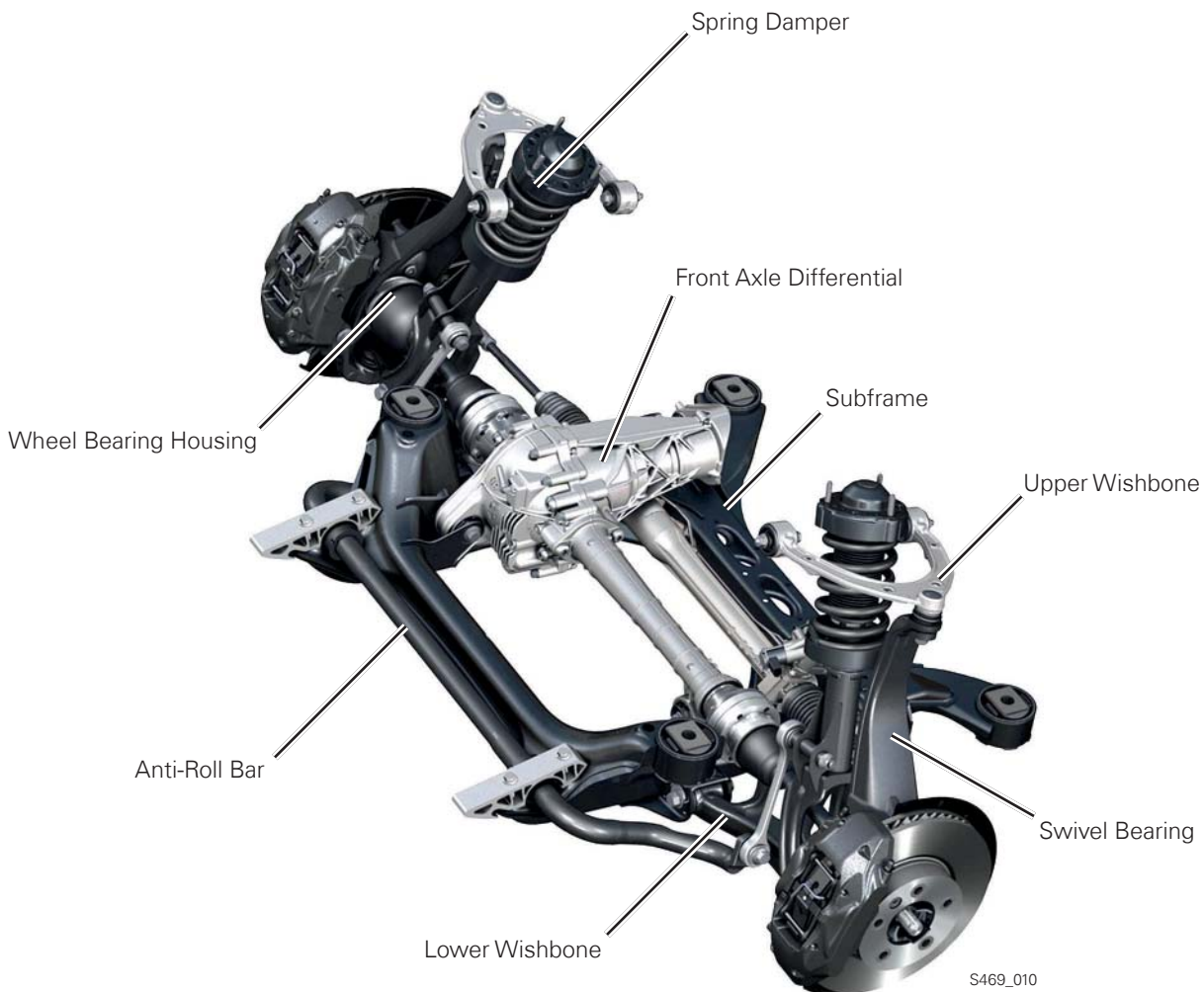


Front and Rear Axle

Front Axle

The front axle on the Touareg uses double wishbone suspension. This design allows maximum spring travel and good axle adaptability on rough terrain. The use of aluminium and omitting the upper wishbone mount has reduced the weight by up to 59 lb (26.7 kg) compared with the previous model.

The decoupled subframe is used to mount the front axle differential and the steering box. On the hybrid version of the vehicle, the lower wishbone and the swivel bearing are made from aluminium.



Front and Rear Axle

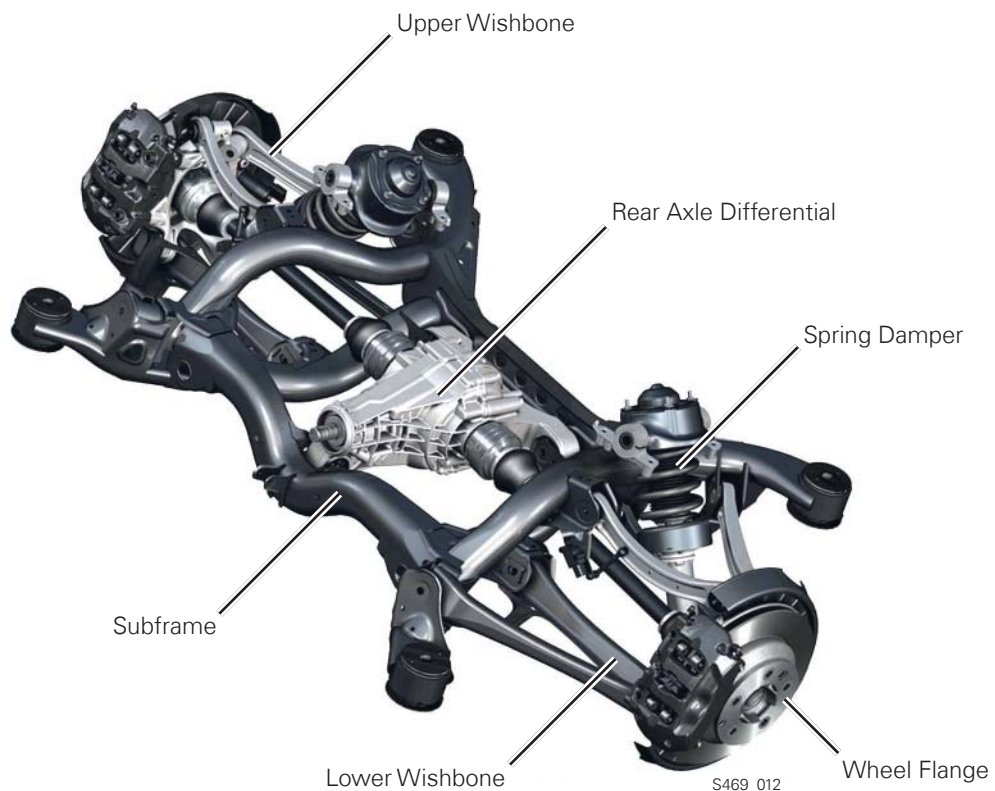
Rear Axle

The Touareg's rear axle also has double wishbone suspension. The lower wishbone and the track rod are made from sheet steel and the upper wishbone from aluminium. The suspension cross member has been integrated into the body. The rear axle decoupled subframe is a tube frame design. The following components are mounted on it:

- Upper and lower wishbone
- Track rod
- Rear axle differential

A 44 lb (20 kg) weight reduction was achieved with:

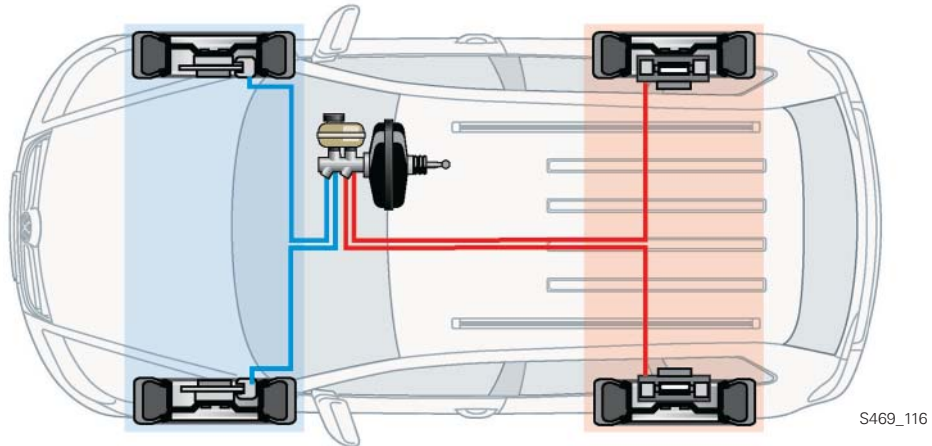
- Lightweight hub carriers made from cast aluminium
- Rear lower wishbone and track rod weight-optimized and made from steel
- Weight-optimized wheel flange and weight-optimized wheel bolts
- Weight-optimized spring dampers



Braking System

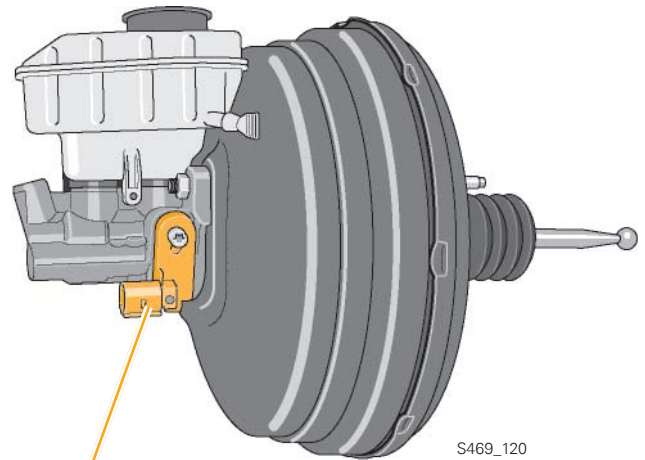
Overview of Components

The 2011 Touareg has a dual-circuit braking system with one braking circuit acting on the front brakes and one braking circuit acting on the rear brakes.



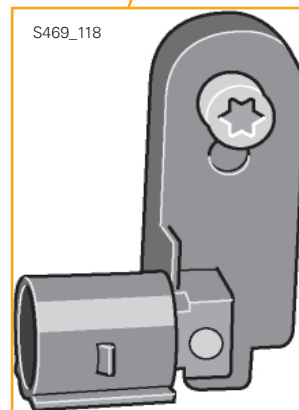
Brake Servo

The Touareg has a 9"/10" tandem brake servo.



Brake Light Switch

The brake light switch is mounted on the brake master cylinder. Since the brake light switch now only has one Hall sensor, the pressure sensor in the ESC Control Module provides a substitute signal.



Braking System

Front Brakes



S469_018

Brembo brake calipers are used for the front brakes on the Touareg. They are made of aluminium and have a monoblock design. The brake discs are internally ventilated.

Engine	Piston	Brake Disc Size
V6 FSI and TDI engine	Steel swivel bearing with 4-piston brake caliper	330 x 32 mm 12.9 x 1.26 in
Hybrid engine	Aluminium swivel bearing with 6-piston brake caliper	360 x 36 mm 14.2 x 1.42 in

Rear Brakes



S469_020

The rear brakes on the Touareg are high-performance brakes with internally ventilated brake discs measuring 330 x 28 mm (12.9 x 1.1 in). The aluminium caliper has four brake pistons.

The electromechanical parking brake is combined with the rear disc brake assembly. The electromechanical parking brake is inside of the brake disc "hat" and is explained over the next few pages.

Braking System

Electromechanical Parking Brake

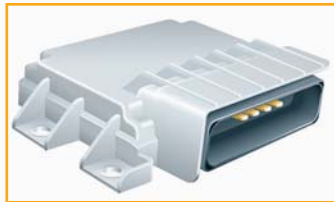
Overview

ESC Control Module J104



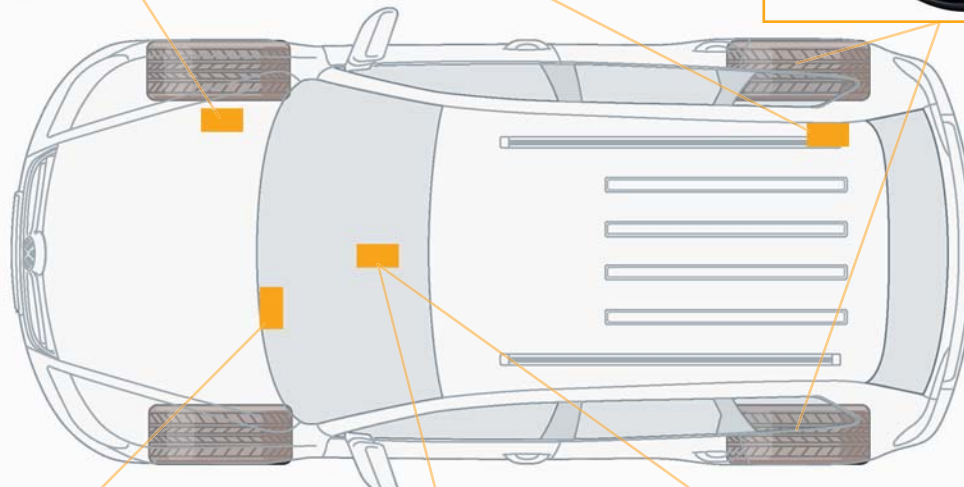
Electromechanical Parking Brake Control Module

Located in the side panel at the right rear. All control and diagnosis tasks of the electromechanical parking brake are performed here.



Rear Wheel Brake Actuators

These are integrated in the dual-servo drum brakes as electromechanical actuators.



S469_033



Electromechanical Parking Brake Warning Lamp K213

Located in the dash panel insert. During a hydraulic braking operation, it lights up green. When the parking brake is applied, it lights up red.



Electromechanical Parking Brake Button

This button is used to activate or deactivate the electromechanical parking brake. This button is located on the left of the gear selector in the center console.



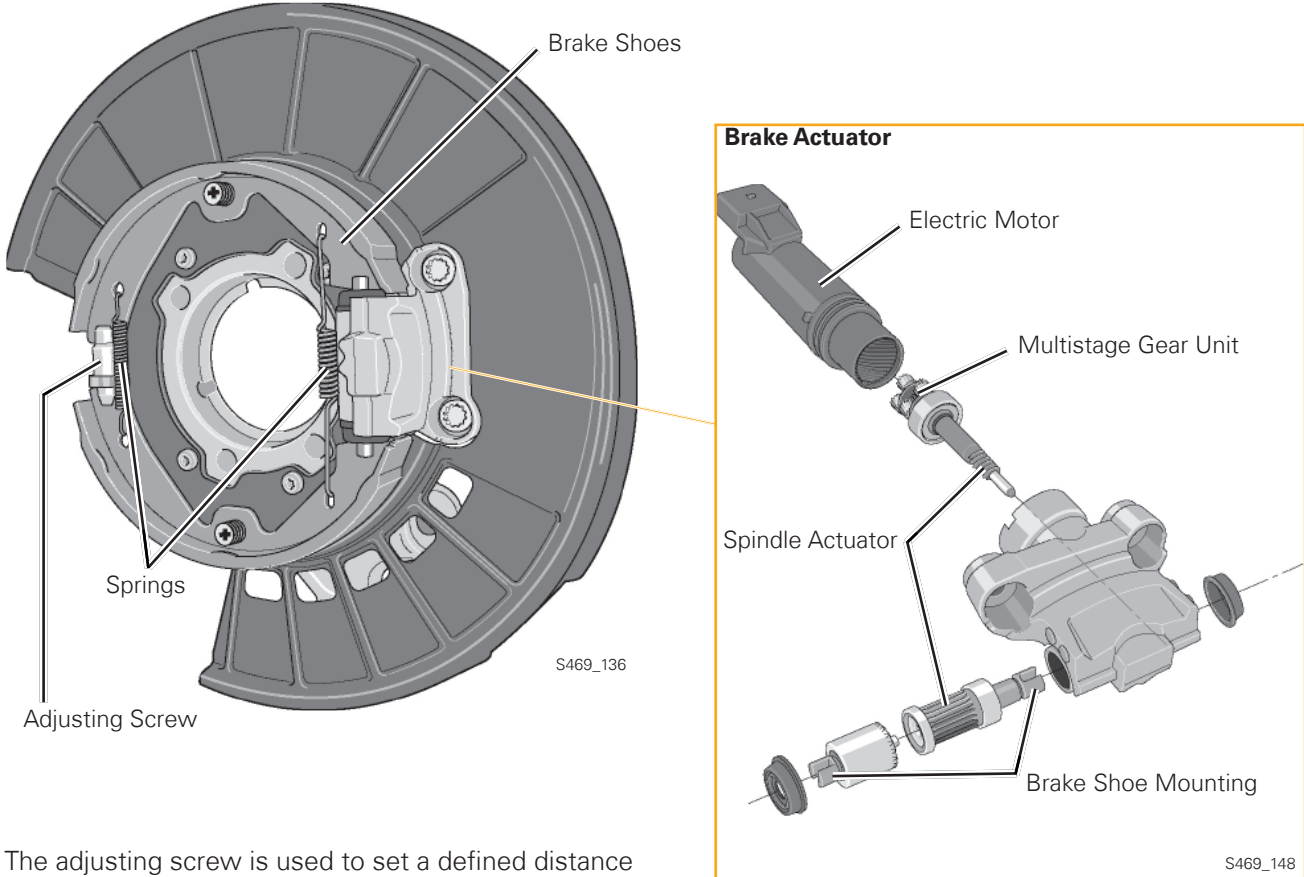
AUTO HOLD Button

This button is used to switch the AUTO HOLD function on and off. This button is located on the left next to the gear selector in the center console.

Rear Wheel Brake Actuators

The electromechanical parking brake operates with dual-servo brakes, (drum brakes are integrated into disc brakes). The drum brakes on the rear wheel are operated by the two electromechanical brake actuators. When the command "apply parking brake" is sent, the actuator activates the electric motor. This moves the multistage gear unit and the spindle actuator. The brake shoes are pushed apart and pressed against the inside of the brake drum.

Design



The adjusting screw is used to set a defined distance between the brake drum and brake shoes.

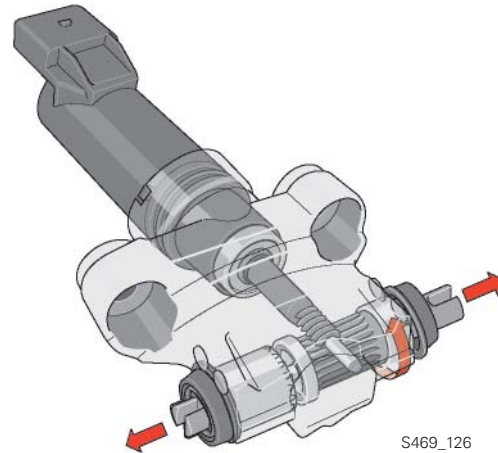
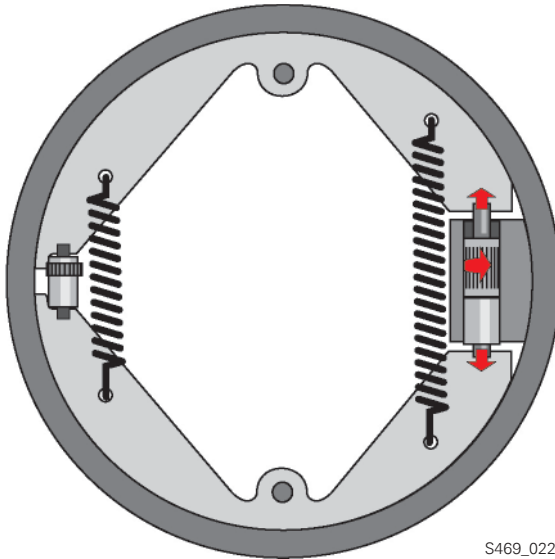


A basic setting needs to be performed after removing and installing the brake shoes. Please refer to ELSA for further information.

Braking System

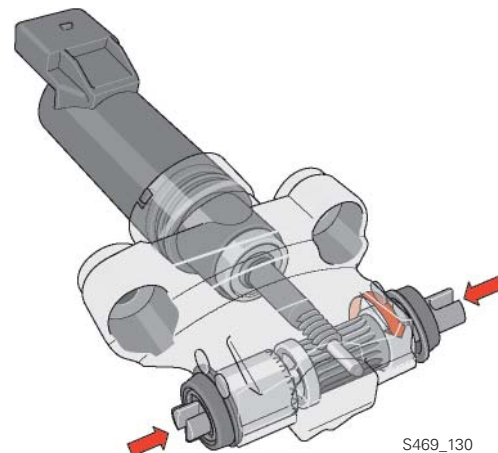
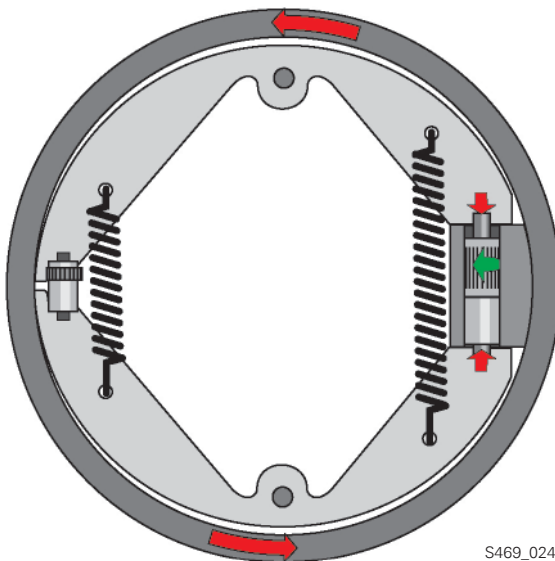
Parking

The rotary movement of the electric motor is converted into linear movement of the brake shoe mountings through the multistage gear unit and the spindle actuator. The brake shoes are pushed apart and pressed against the inside of the brake drum.



Releasing

The brake shoe mountings move in opposite directions. The springs pull the brake shoes together to a set value. This value depends on the adjusting screw and the actuator and defines the gap between the brake shoe and brake drum.



Functions of the Electromechanical Parking Brake

The electromechanical parking brake has the following functions:

- Parking brake
- Dynamic auto release
- Dynamic emergency brake

ABS/ESC Anti-Lock Brake System Continental/Teves MK 25 A-XT

The 2011 Touareg features a new ESC unit. The MK 25 A-XT ESC system has been developed for vehicles with high axle loads. The essential new features include:

- Analogue separation and inlet valves
- Sensor cluster with combined rotary rate, lateral and longitudinal acceleration sensor
- Integrated brake pressure sensor

The MK 25 A-XT system has the following functions:

- ABS
- ABS Plus
- HBA (hydraulic brake assist)
- FRAD (maximum rear axle braking)
- Automatic hazard warning lights
- Overboost
- ESC
- Brake disc dry braking
- Vehicle/trailer stabilization
- Roll-over prevention (ROP)
- Prefill function (brake pads rest against brake discs)
- TCS
- EBC (engine braking effect control)
- EDL (electronic differential lock)
- Dynamic emergency braking function, ECD (Electronic Controlled Deceleration)
- AUTO HOLD
- Hill descent assist system



Braking System

ON ROAD and OFF ROAD Driving Program

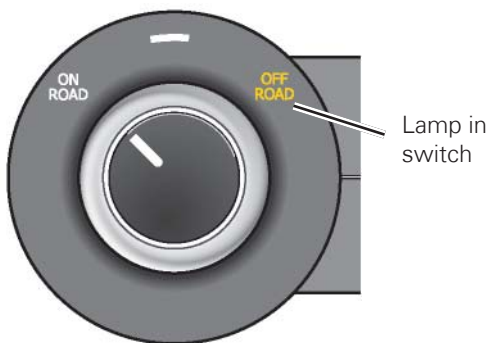
The 2011 Touareg has ON ROAD and OFF ROAD driving programming with the following functions:

ON ROAD:

- Driving on surfaced roads

OFF ROAD:

- ABS Plus: Raised threshold for better wedge formation on loose surfaces (e.g. sand)
- EDS/ASR: Later intervention in torque regulation, EDL control even at low levels of slippage
- Hill descent assist system
- Adapted shift program with shallow accelerator characteristic curve and no automatic upshifting in the Tiptronic gate



When the vehicle is set to the OFF ROAD driving program, the lamp in the switch illuminates.



S469_062

The function lamp for the hill descent assist system illuminates to indicate that the system is ready. The function lamp flashes when the system is active.



Function lamp for hill descent assist system

S469_064

Stationary Vehicle Management

The stationary vehicle management ensures secure footing in many situations. The following systems influence the stationary vehicle management:

- Aisin 1000 torque converter
- EPB, electromechanical parking brake
- ESC, hydraulic brakes
- Engine control module with start/stop system

The stationary vehicle management is implemented by:

- **AUTO HOLD**

Holds the vehicle stationary after braking to a standstill and release of the brake pedal.

- **HILL HOLD**

Prevents the vehicle rolling back after rolling to a stop or braking with the brake pedal on an incline and also makes pulling away simple.

- **Electromechanical Parking Brake, EPB**

Safely holds the vehicle stationary on uphill slopes or downhill slopes, regardless of ground inclination.

Braking System

AUTO HOLD Function

The AUTO HOLD function holds the vehicle on a maximum uphill slope or maximum downhill slope of 30%. At first the vehicle is held in place using hydraulic pressure. However, if the hydraulic pressure is held for too long, the solenoids in the ESC module can overheat. As a result, after 3 minutes, the hydraulic brake application is “handed over” to the electromechanical parking brake (EPB). This prevents the coils of the ESC solenoid valves from being damaged. The hold function is only ended when the driver wants to pull away or ends the AUTO HOLD function by pressing the button.

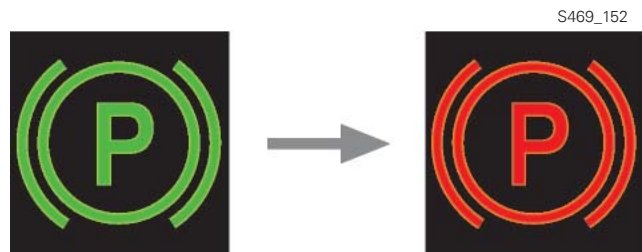
Activation conditions:

- EPB, ESC fault-free
- Driver's door closed
- Driver's belt lock engaged
- AUTO HOLD button pressed
- Engine is not running in non-hybrid vehicles
- Ready to drive with hybrid vehicles (Ready indicator in display)

Readiness is indicated by the warning lamp for AUTO HOLD, which is in the AUTO HOLD button.

Function procedure:

- Driver brakes hydraulically, electromechanical parking brake warning lamp K213 = green
- Vehicle is held hydraulically. To protect the valve coils in the ESC control module against overheating, the handover to the EPB will occur after 3 minutes at the latest (K213 turns red).
- If the vehicle rolls back, brake pressure is built up one single time via ESC.
- If the vehicle rolls again, handover to EPB (K213 turns red).

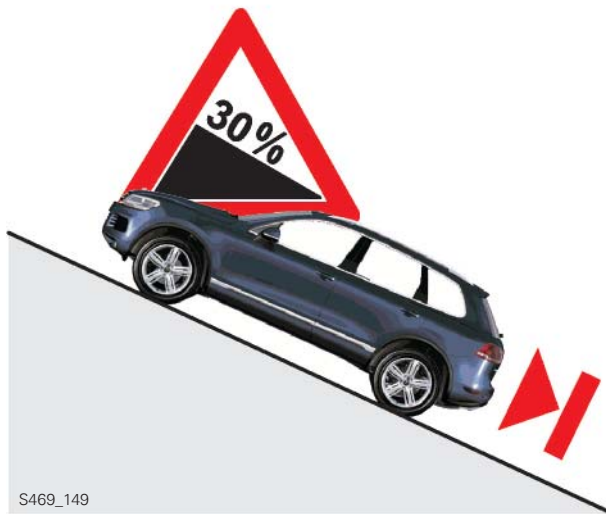


Upon handover to the EPB, the electromechanical parking brake warning lamp K213 in the dash panel insert changes from green to red.

HILL HOLD Function

The HILL HOLD function prevents the vehicle rolling backwards on gradients when gears D or S are selected or when the selector is in the shifting/Tip gate. This occurs both when braking to a standstill and also when rolling to a stop on uphill slopes. This function is always active. There is no indicator for the HILL HOLD function in the dash panel insert.

The hold function is performed by the transmission. If the transmission oil temperature is too low ($<10^{\circ}\text{C}$), the HILL HOLD function is taken over by the ESC function or by the EPB after 3 minutes. The HILL HOLD function is only ended when the driver wants to pull away.



Activation conditions:

- Gears D, S or Tip gate
- Engine running
- Ready to drive in hybrid vehicles (Ready indicator in display)

Function procedure:

Transmission oil temperature greater than $+10^{\circ}\text{C}$:

The vehicle is held by the transmission locking freewheel of the 8-speed automatic transmission. You will find more information in SSP 850103 "The OC8 8-speed Automatic Transmission."

Transmission oil temperature less than $+10^{\circ}\text{C}$:

- If the driver brakes the vehicle or the vehicle rolls to a stop, it will be held hydraulically. In order to protect the valve coils in the ESC control module against overheating, the handover to the EPB will take place after 3 minutes at the latest (K213 turns red).
- If the vehicle rolls back, brake pressure is built up one single time via ESC.
- If the vehicle rolls again, handover to EPB (K213 turns red).

Braking System

Restart Assist System (Hybrid)

The restart assist system is directly linked to the start/stop function. It prevents the vehicle from jolting when the engine is restarted.

If the driver starts the engine by releasing the brake pedal, the engine torque is passed to the wheels through the drive train. The vehicle is held in place by the brakes (hydraulically) until the engine reaches its idling speed.

The restart assist system operates independently of the gradient and gear and is only available when the AUTO HOLD function is not active. The restart assist system does not have a switch or a warning lamp. There is no feedback for the driver about this function being activated.

Activation Conditions:

Engine restart after start/stop

Function Procedure:










- When the brake pedal is used, the driver braking pressure is stored.
- Stop phase until the engine is started.
- The hydraulic brake is released.



S469_147

Braking System

Summary of Stationary Vehicle Management

	HILL HOLD	AUTO HOLD button pressed
Vehicle rolls to a stop. Transmission oil temperature less than 10°C	<ul style="list-style-type: none"> ESC (pump builds up pressure) After 3 min handover to EPB 	 ↓ 
Driver brakes to a standstill. Transmission oil temperature less than 10°C	<ul style="list-style-type: none"> ESC (driver braking pressure is stored) After 3 min handover to EPB 	<ul style="list-style-type: none"> ESC (driver braking pressure is stored) After 3 min handover to EPB  ↓ 
Vehicle rolls to a stop. Transmission oil temperature greater than 10°C	<p style="text-align: center;">– – Vehicle is held by transmission</p>	
Driver brakes to a standstill. Transmission oil temperature greater than 10°C	<ul style="list-style-type: none"> Vehicle is held by transmission. ESC (driver braking pressure is stored) After 3 min handover to EPB 	 ↓ 
Start/stop function/ engine off	<ul style="list-style-type: none"> Restart assist system ESC (driver braking pressure is stored) After 3 min handover to EPB 	 ↓ 

Steering

Steering

The 2011 Touareg uses a speed-dependent, hydraulic rack-and-pinion steering system with a more direct steering gear ratio. That means that the front wheels are turned further when compared to the degree the steering wheel is turned.

Oil is supplied by a regulated power steering pump driven by the combustion engine. It has controlled volume delivery. This assures that the pump is not working more than necessary, reducing CO² emissions.

Steering Wheels

Multiple steering wheels made from wood and leather with multifunction buttons are available for the 2011 Touareg.



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S469_038

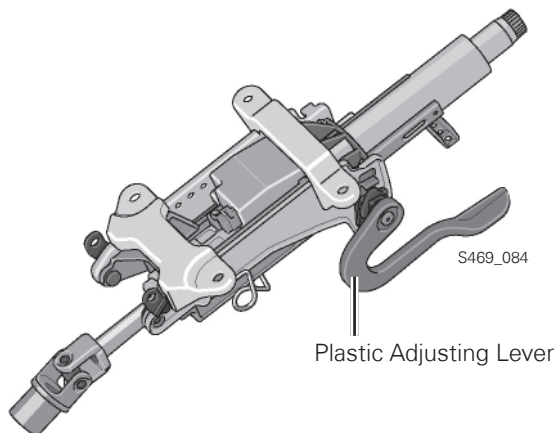
Steering Column

Either a mechanically adjusted steering column or an electrically adjusted steering column are available for the 2011 Touareg. Both steering columns use a new steering column with new connecting points. The steering columns, which were developed by Thyssen Krupp Presta, are approx. 0.6 lb (0.3 kg) lighter than the ones used in the previous model. Both variants have an electrical steering column lock. The electrical steering column lock can be replaced separately.

Adjustment range:

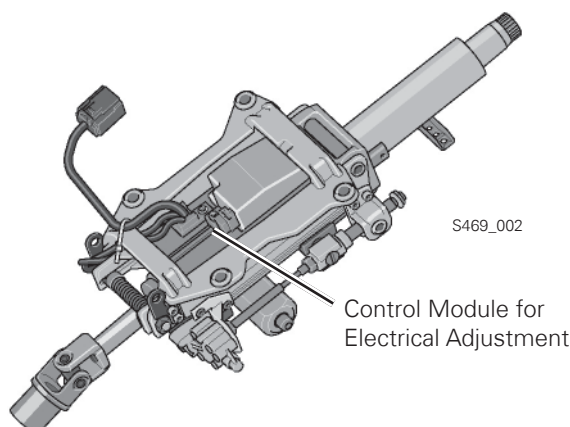
- Longitudinal adjustment at bottom approx. 6.3 in (16 cm)
- Longitudinal adjustment at top 2.4 + 2.8 in (6 + 7.1 cm) crash travel
- Height adjustment 2 in (5 cm)

Mechanically Adjusted Steering Column



- Plastic adjusting lever at side with predetermined breaking point
- Wedge disk/cam clamping system
- Form fit height and longitudinal adjustment due to stricter crash requirements
- Height adjustment with toothed strip on both sides
- Longitudinal adjustment with toothed plate

Electrically Adjusted Steering Column (EASC) with Memory Function



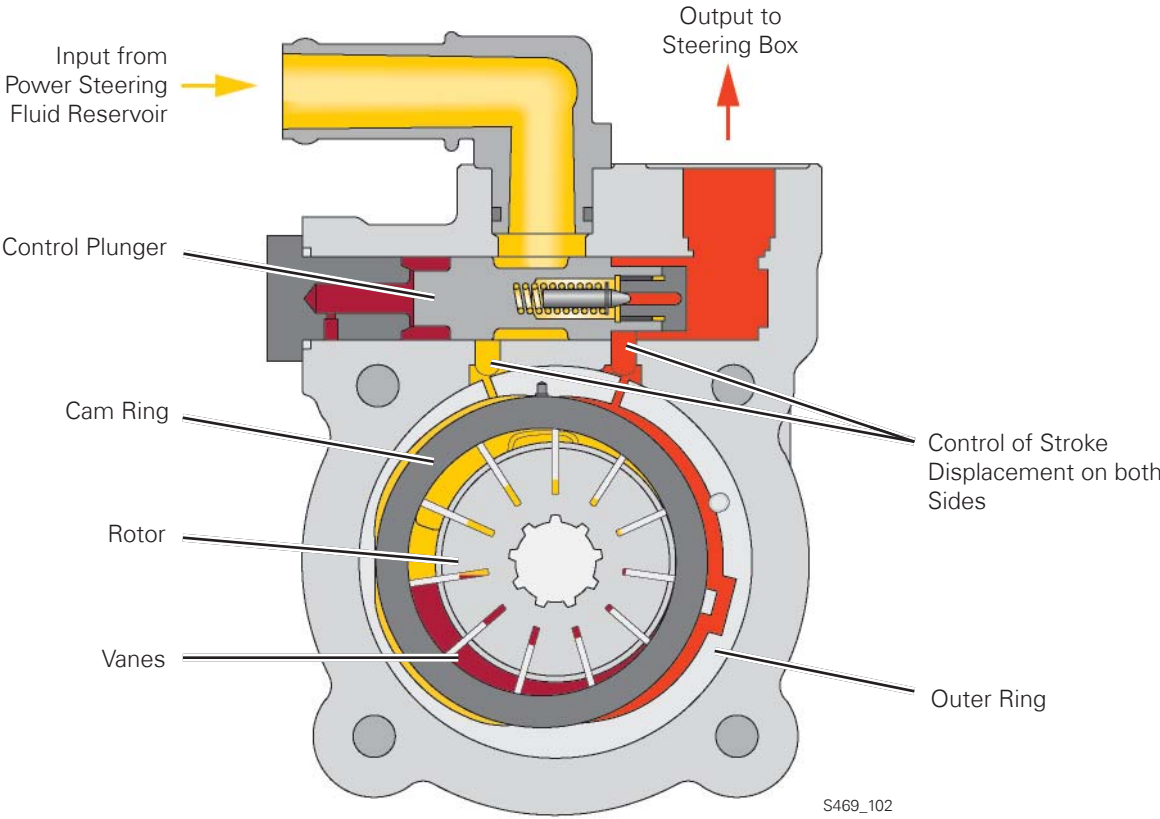
- Control module for electrical adjustment on the steering column

Steering

Hydraulic Power Steering Pump

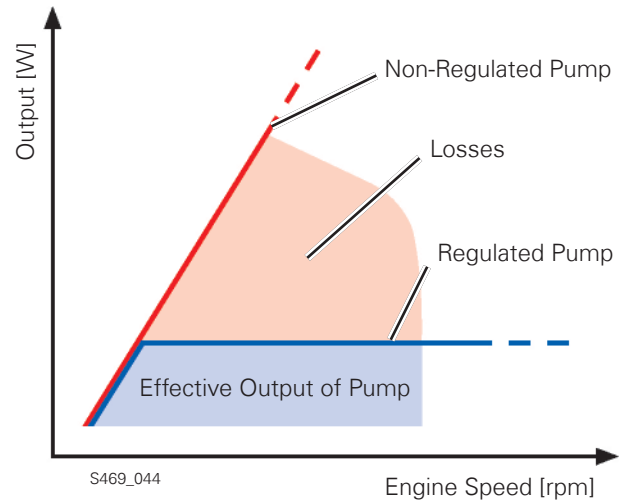
The power steering pump is a regulated power steering pump manufactured by ZF with a delivery volume of up to 5.1 in³ (83.6 cm³) per minute.

Design



Performance Comparison: Non-Regulated and Regulated Pump

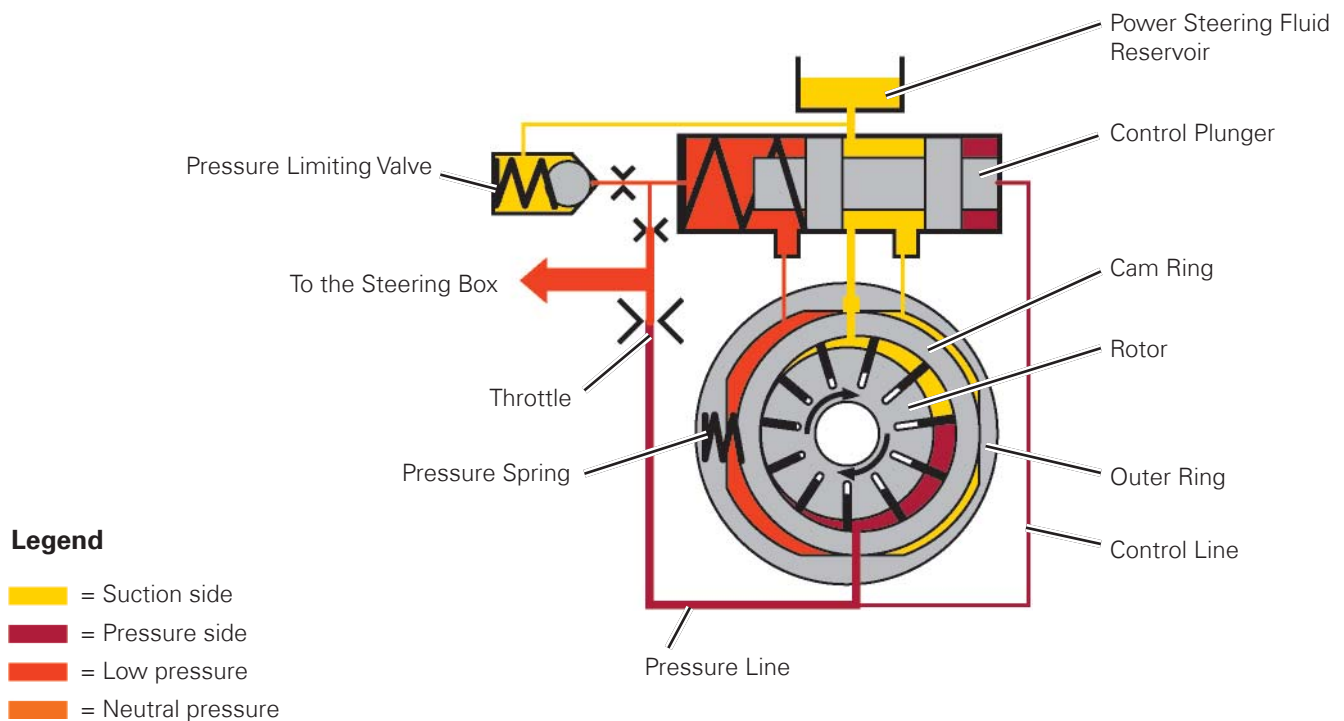
The fuel saving is approx. 0.15 liters (0.04 gallons) per 62 miles (100 km). At engine speeds above 4000 rpm, the fuel savings are approx. 0.8 liter (0.2 gallons) per 62 miles (100 km) compared with a non-regulated pump.



Function

At Idling Speed:

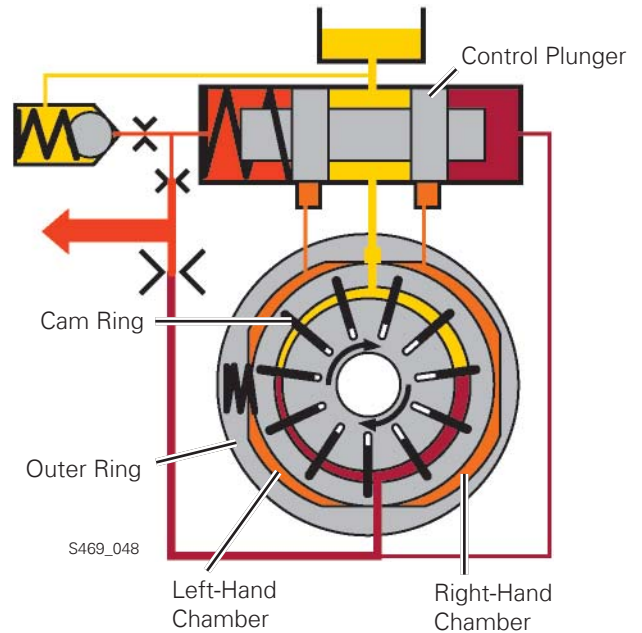
The pump cam ring is pressed against the outer ring by the spring force and the internal pressure conditions. The largest possible delivery volumes result on the suction and pressure sides. The delivery volume rises proportionally as the engine speed increases.



Steering

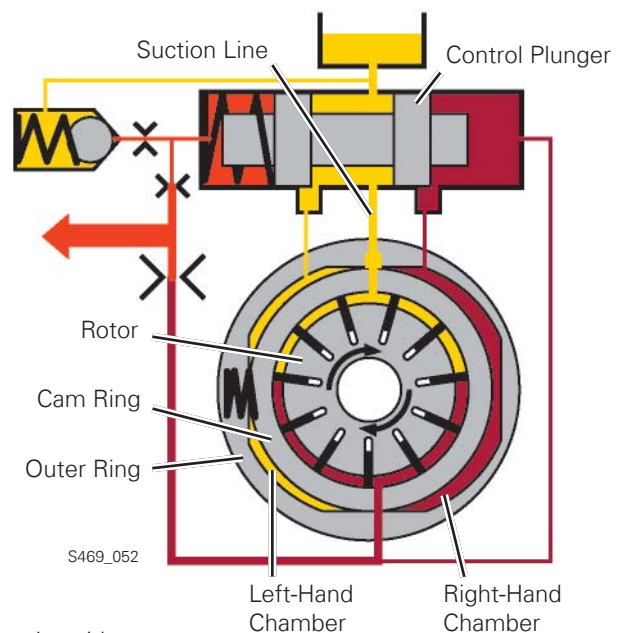
As the Engine Speed Rises:

The pressure in the pump rises with engine speed. The pump pressure is applied on one side of the control plunger and the control plunger is moved to the left against the spring force as the pressure rises. Within a defined medium engine speed range, the channels to the chambers between the outer ring and the cam ring are closed by the control plunger. This results in pressure equilibrium between the left-hand and right-hand chamber. The cam ring is held in a defined central position and the delivery volume remains almost constant.



If Engine Speed Continues to Rise:

The delivery volume and pressure continue to increase with engine speed. The control plunger is moved further to the left against the spring force. This connects the channel to the left-hand chamber with the suction line. Pump pressure reaches the opposite right-hand chamber. The cam ring is pushed against the spring force to the left. This reduces the eccentricity between the rotor and cam ring. The delivery volume is reduced and excessive pressure increase is prevented. Power consumption is reduced considerably due to less pump drag.



Legend

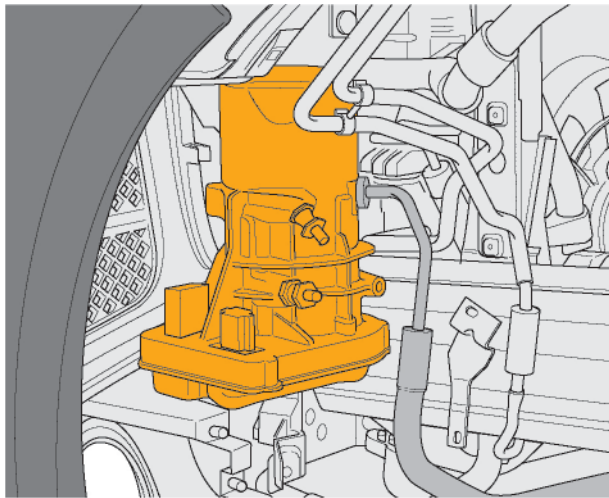
- = Suction side
- = Pressure side
- = Low pressure
- = Neutral pressure

Hybrid Electrical Components

Electrical Running Gear Components in Hybrid Version

When the electric motor is powering the vehicle, the combustion engine may be decoupled and off. When this happens, the running gear components still need to be driven. Electric motors take over all functions normally performed by the combustion engine. These motors supply power to systems such as the braking system and power steering system.

Electrical Power Steering Pump V466



S469_100

The power steering pump for the electrohydraulic power steering is located in the front left wheel housing underneath the headlight.

Task

It provides working pressure for the power steering hydraulic system. Regulation is determined by vehicle speed, the steering angle and the speed at which the steering wheel is turned.

Effects Upon Failure

If the power steering pump fails, there is no steering assistance. The steering can still be operated with greater effort.

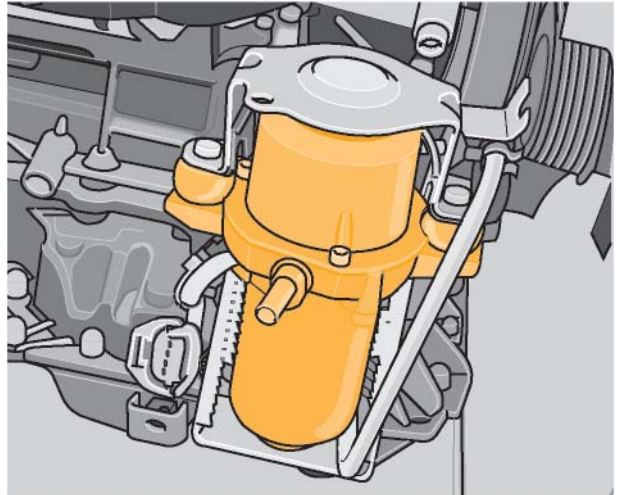
Hybrid Electrical Components

Brake Servo Vacuum Pump V469

Attached to the front right, under the engine.

Task

The brake servo vacuum pump is solely responsible for creating the vacuum when in electric mode. This vacuum provides the necessary pressure for the brake servo assistance. It can also run in a supportive role during start-up and in combustion engine mode. In the case that it is playing a supportive role, the vacuum pump would continue to provide the vacuum required to control functions in the coolant pump for the combustion engine. An internal pressure accumulator ensures a pulse-free, constant vacuum.



S469_154




Effects Upon Failure




If the vacuum pump is faulty, the combustion engine will start. The vehicle will no longer operate in electric-only mode.

Wheels and Tires

Overview

Alloy wheels from 17" to 20" are available for the 2011 Touareg. The 17" and 18" tires have a diameter of 29.5 in (75 cm). The 19" and 20" tires have a larger diameter of up to 30 in (76.2 cm).

			
S469_070	S469_072	S469_074	S469_076
Sonora	Atacama	Tacora	Karakum
7.5Jx17 ET50	7.5Jx17 ET50	8Jx18 ET53	8Jx18 ET53
235/65R17 108V	235/65 R17 108V	255/55 R18 109W	255/55 R18 109W
255/60 R17 106V	255/60 R17 106V		
235/65R17 108V	235/65 R17 108V	255/55 R18 109V	255/55 R18 109V

		
S469_078	S469_080	S469_082
Everast	Pikes Peak	Metropolitan
8.5Jx19 ET59	9Jx20 ET57	9Jx20 ET57
265/50 R19 110V	275/45 R20 110W	275/45 R20 110W
265/50 R19 110W		
265/50 R19 110V		Winter Tires
Without Chain	Without Chain	Without Chain

The Touareg comes with a breakdown set (Tire Mobility Set) as standard equipment. There is no spare wheel with a full-size tire.

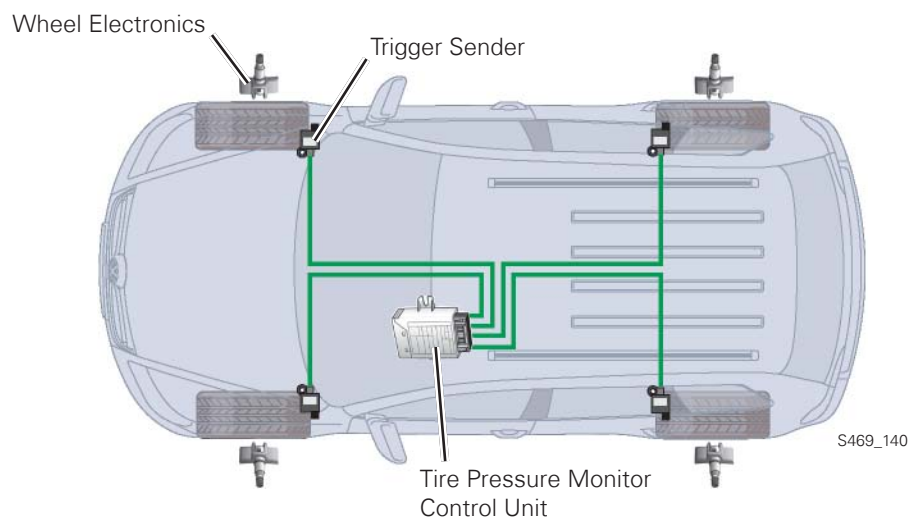
Not all wheels shown may be available in all markets.

Tire Pressure Monitor

Overview

The tire pressure monitoring system allows position-related (to all four wheels) tire pressure monitoring using the following components:

- A tire pressure monitor control module with integrated aerial
Location: Driver-side longitudinal member, near to B-pillar,
- Four trigger senders in the wheel housings
- Four wheel electronics in the vehicle tires

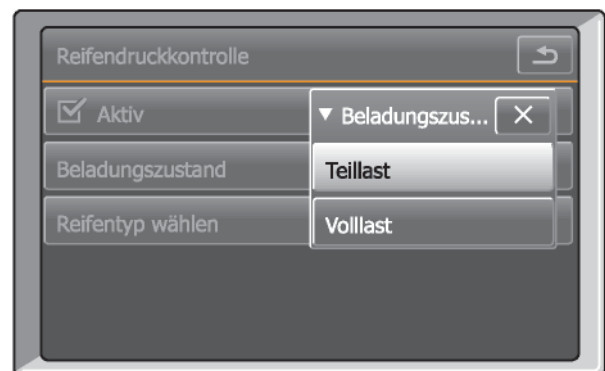


The control module can address each of the four wheel electronics with an LF (Low Frequency) radio signal and request sending of a data signal using the trigger senders. This data signal is received by the control module and immediately evaluated for the corresponding wheel position.

Settings

The vehicle-specific target pressure is stored in the control module at the factory. If the vehicle has several different target pressures, they can be changed in the settings menu by selecting the tire dimension.

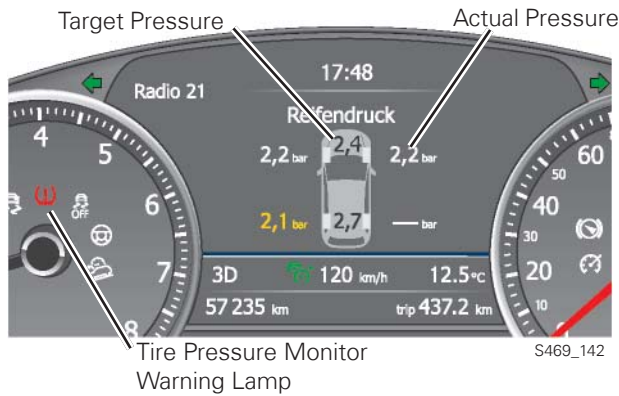
Additional target pressures can be added for custom tires. In the settings menu, you can also select the vehicle load if it is relevant to the tire pressure.



S469_158

Tire Pressure Monitor

Function



If the actual pressure deviates from the set pressure too much, the tire pressure monitor warning lamp in the dash panel insert will illuminate. The warning status is also indicated by text messages and the actual pressure of the individual tires is displayed in the dash panel insert.

Warning Messages

Text Message	Tire Pressure	Warning Status
"Check tire pressures"	Actual pressure < target pressure (pressure difference - 0.3 bar)	Note: No tire pressure monitor warning lamp
"Tire pressures too low"	Actual pressure < target pressure (pressure difference - 0.5 bar)	Hard warning I Tire pressure monitor warning lamp lights up
"Flat tire!"	Actual pressure < 1.4 bar or pressure loss > 0.2 bar/min	Hard warning II Tire pressure monitor warning lamp lights up + gong

If there is a system fault the tire pressure monitor warning lamp flashes for approx. 65 seconds, then illuminates constantly.

Coding

There are two coding variants:

- In the first variant, the tire pressure monitor is turned off automatically when you start a journey (if the wheels were installed without wheel electronics).
If the system has been turned off, it will be automatically activated as soon as it detects at least one electronic wheel unit on the vehicle (e.g. after a wheel is changed).
- In the second variant (USA only), turning off is prohibited by law.

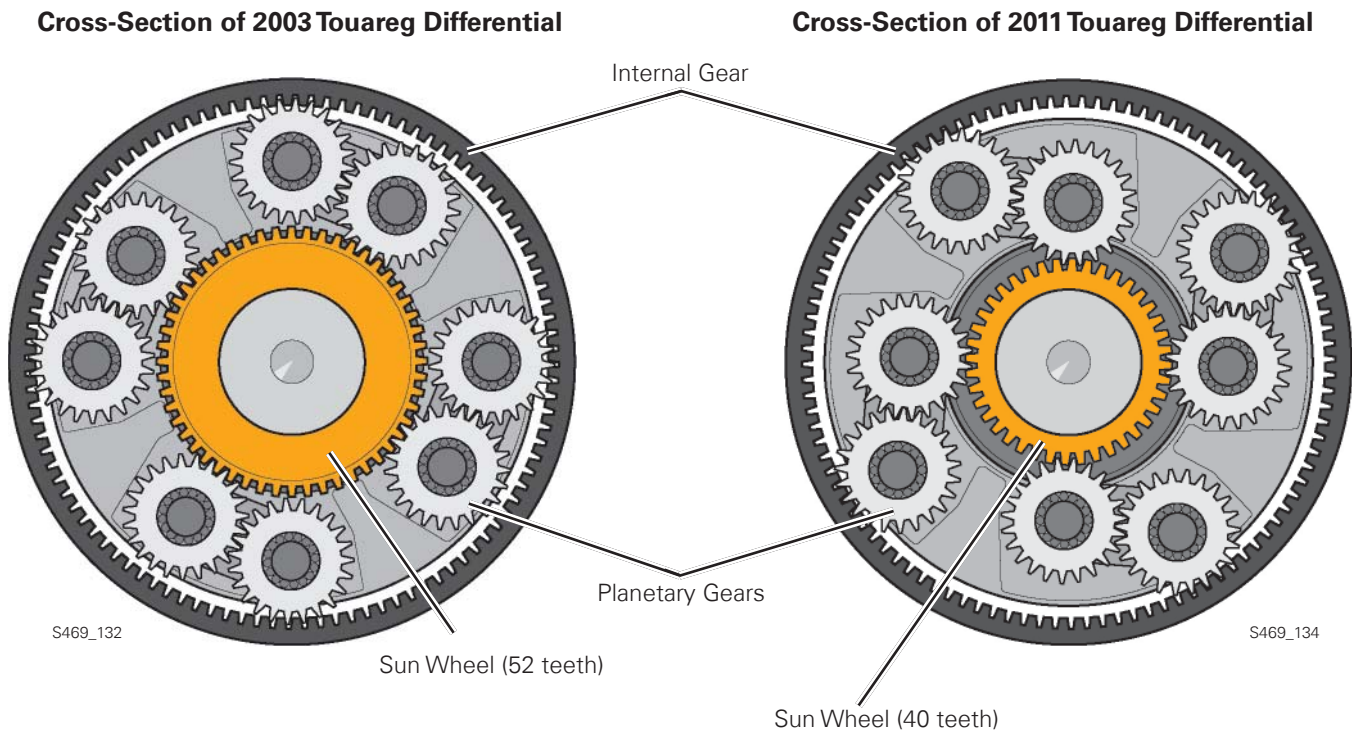
Transfer Case

Transfer Case 0BV

As an optional extra feature (4XMOTION), the 2011 Touareg is available with:

- The center differential with reduction stage
- Transfer case
- Longitudinal lock
- Rear axle differential with axle differential lock.

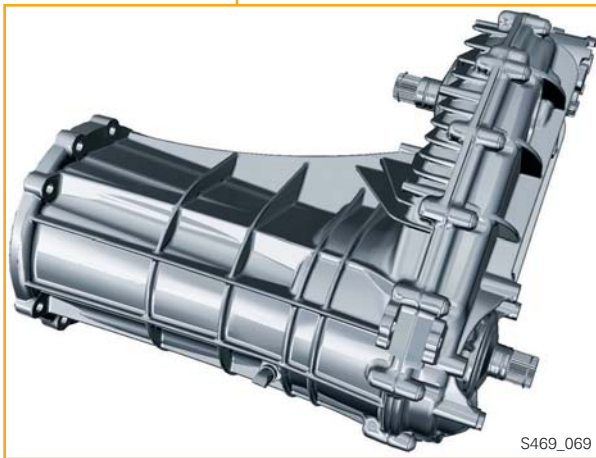
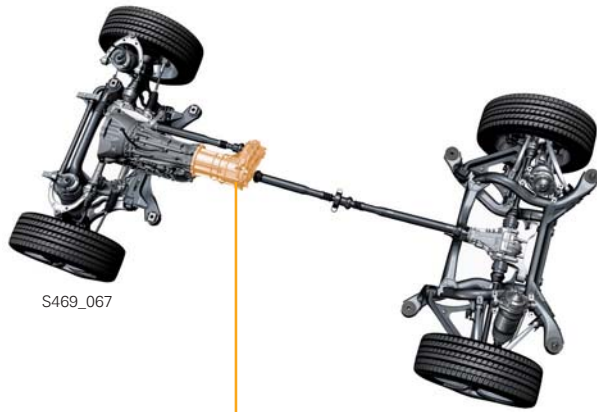
The basic torque distribution has changed compared with the 2003 Touareg. In the 2003 Touareg, the distribution in the differential was 50:50 between the front and rear axles. In the 2011 Touareg, the torque is distributed at a ratio of 38:62 between the front and rear axles. This has been achieved by giving the sun wheel in the planetary gear set a smaller pitch circle diameter.



Basic distribution in differential 50:50

Basic distribution in differential 38:62

Transfer Case 0BU



The transfer case 0BU is part of the basic equipment version (4MOTION). It is a self-locking center differential and has the task of compensating the different speeds at the front and rear axles as well as distributing the drive power between the axles, depending on available traction. The transfer case operates purely mechanically and reacts immediately to changes in driving situations. Its compact design, low weight, and lifetime oil filling mean that the transfer case is maintenance-free and reliable.

Technical Data

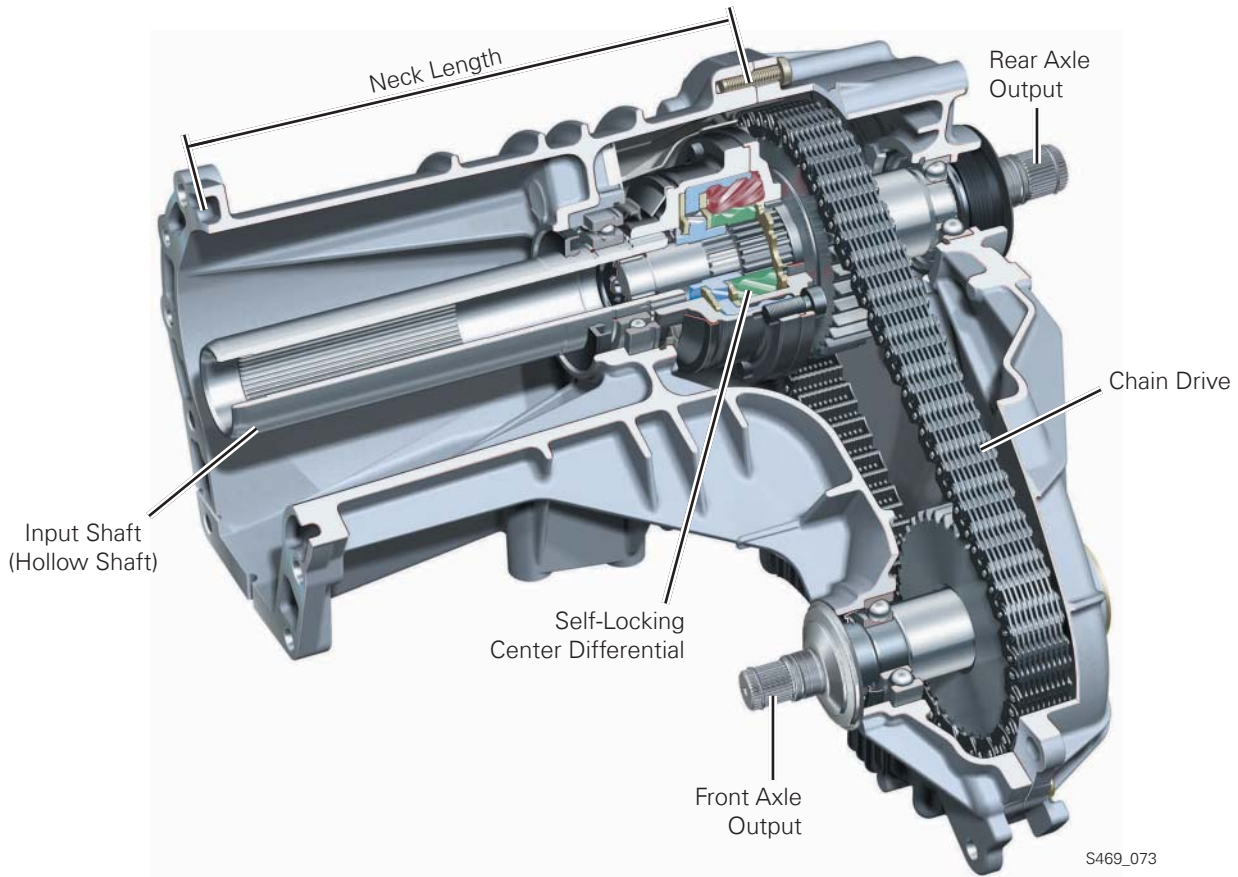
Manufacturer	Magna Powertrain
Transmission Code	0BU
Torque	up to 590 lb/ft (800 Nm)
ATF Oil Part Number	see electronic parts catalog Lifetime oil filling
Weight	approx. 55 - 69 lb (25 - 31 kg)

The weight of the transfer case depends on the engine/transmission combination. The following components of the transfer case may vary for differing equipment levels:

- the drive chain
- the drive chain sprockets
- the neck length of the transfer case

Transfer Case

Design



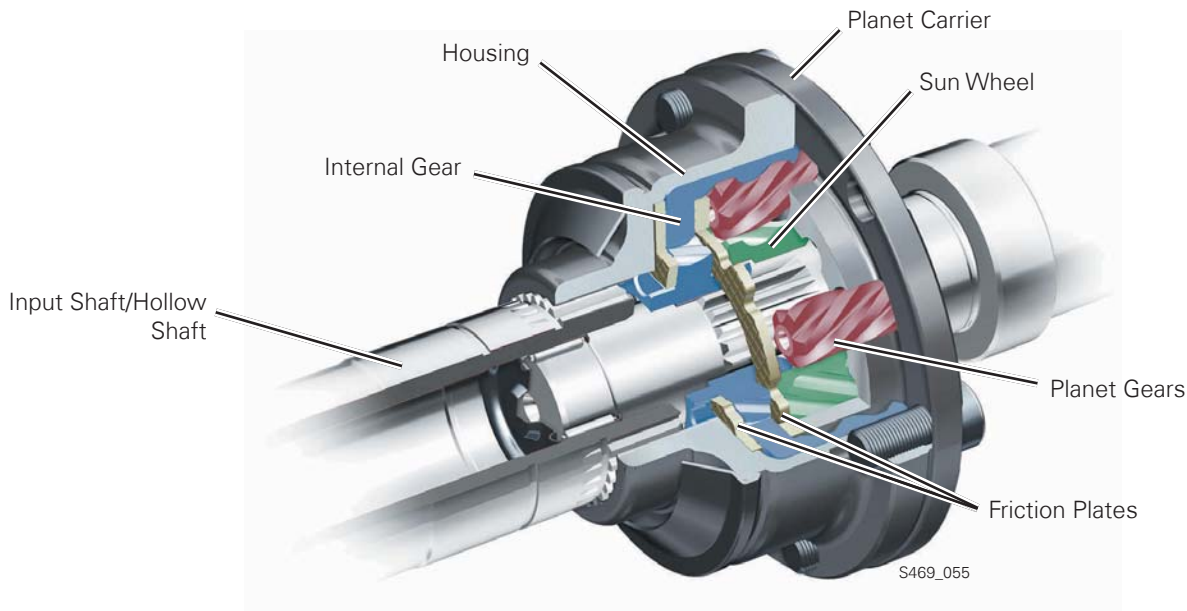
The transfer case is attached directly to the automatic transmission. There are different neck lengths to go with the different engine and transmission variations.

The hollow input shaft transmits the transmission output torque to the transfer case. The differential compensates the different speeds of the axles and distributes the drive torque.

Power is sent to the rear axle through an output shaft that is directly inline with the input shaft. The upper chain sprocket is mounted on the output shaft. The chain transfers torque between the output sprockets and to the front axles.

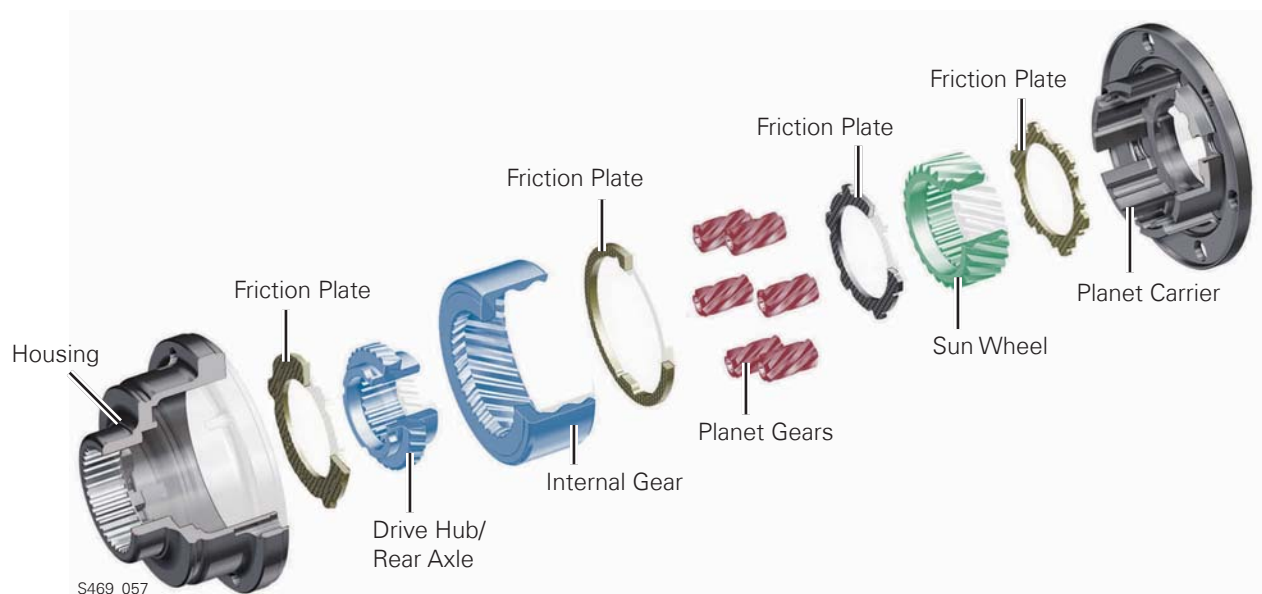
Planetary Gear Set

Design



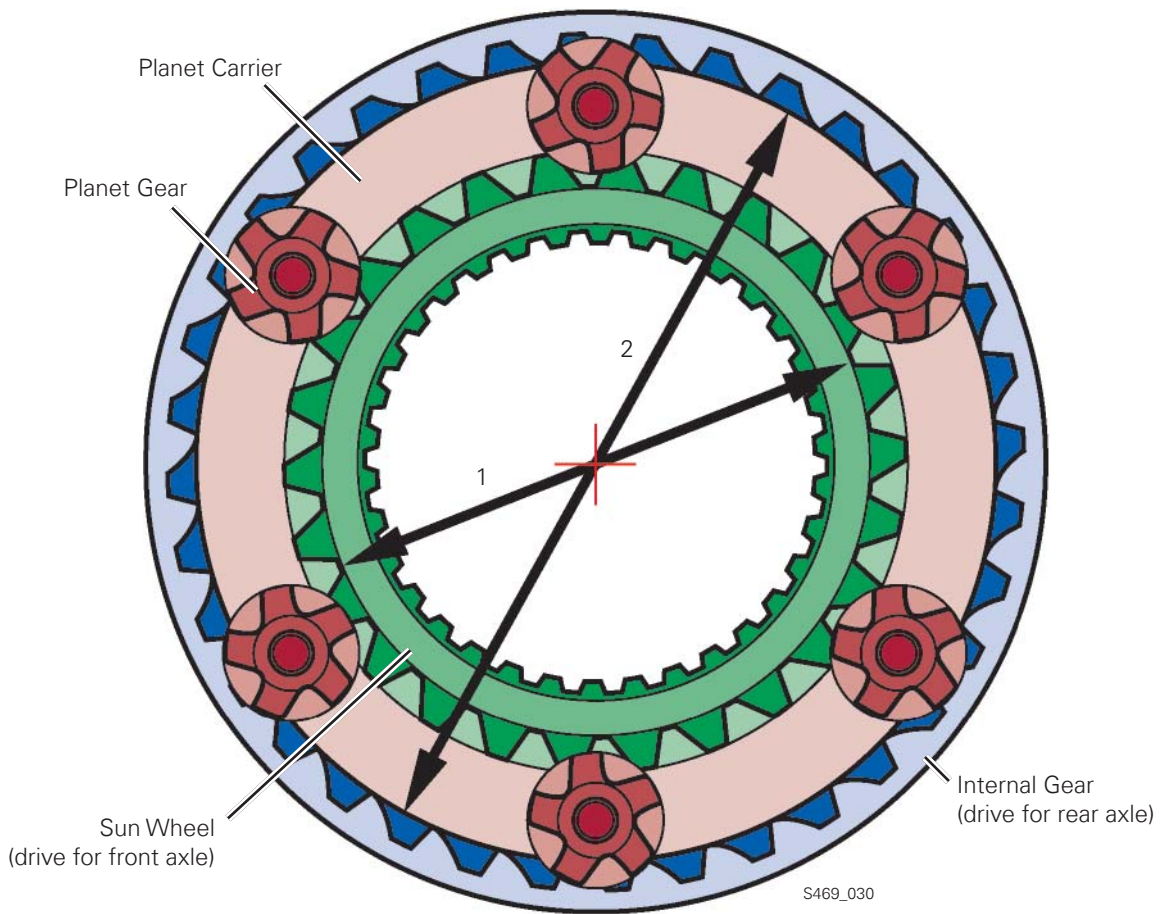
The basic set-up of the self-locking center differential is a simple planetary gear set with a planet carrier, planet gears, an internal gear, and sun wheel.

In addition, friction plates are installed in the center differential. The friction plates are made from nickel-plated steel. These friction plates and the ATF oil influence the frictional torque and the locking value of the differential. The frictional torque comes from the self-locking nature of the helical toothing and the force of the sun wheel and internal gear acting on the friction plates.



Transfer Case

Asymmetric Basic Distribution



The transmission output is distributed unequally (40:60 front axle to rear axle). The different pitch circle diameters of the sun wheel (output to front axle) and internal gear (output to rear axle) create this unequal distribution.

- 1 = smaller pitch circle diameter:
short lever arm/lower torque to front-axle drive
- 2 = larger pitch circle diameter:
longer lever arm/greater torque to rear-axle drive

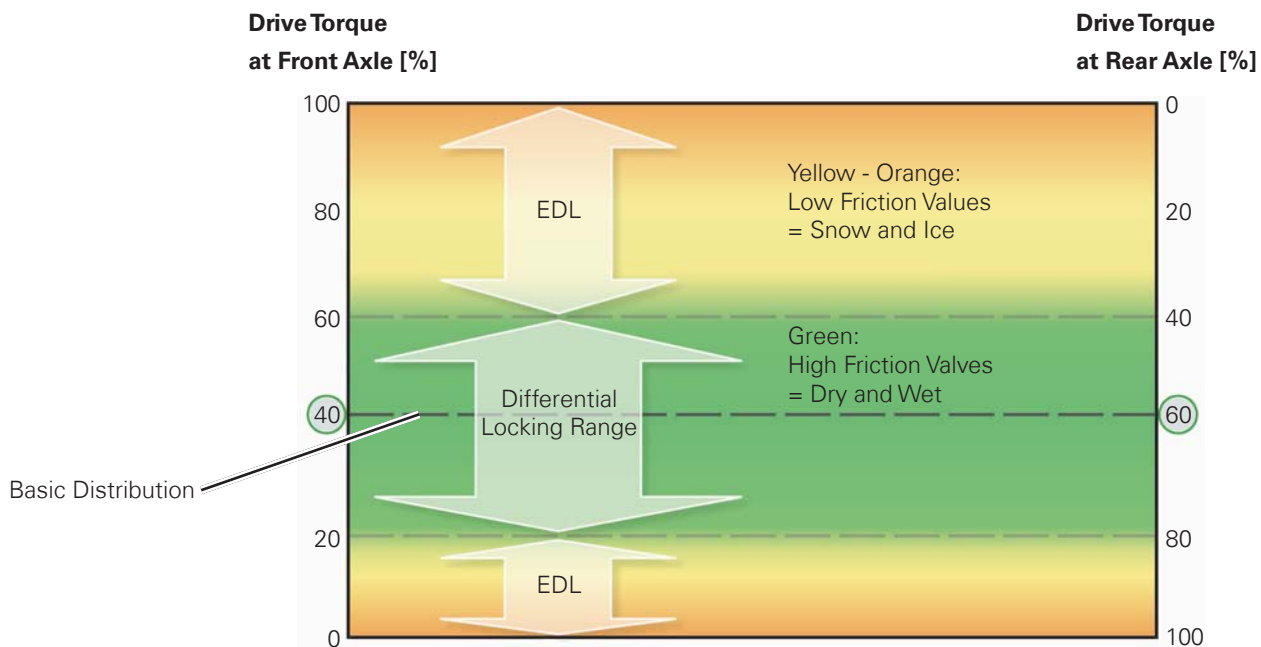
Transfer Case

Asymmetric/Dynamic Torque Distribution

The function of the differential is to distribute torque between the front and rear axles.

- 20% to 60% of the transmission output torque is sent to the front axle.
- 40% to 80% of the transmission output torque is sent to the rear axle.

The EDL intervenes outside the locking range of the differential.



In addition to the 40:60 distribution, a frictional torque is created in the differential that is proportional to the drive torque and results in a corresponding locking torque.

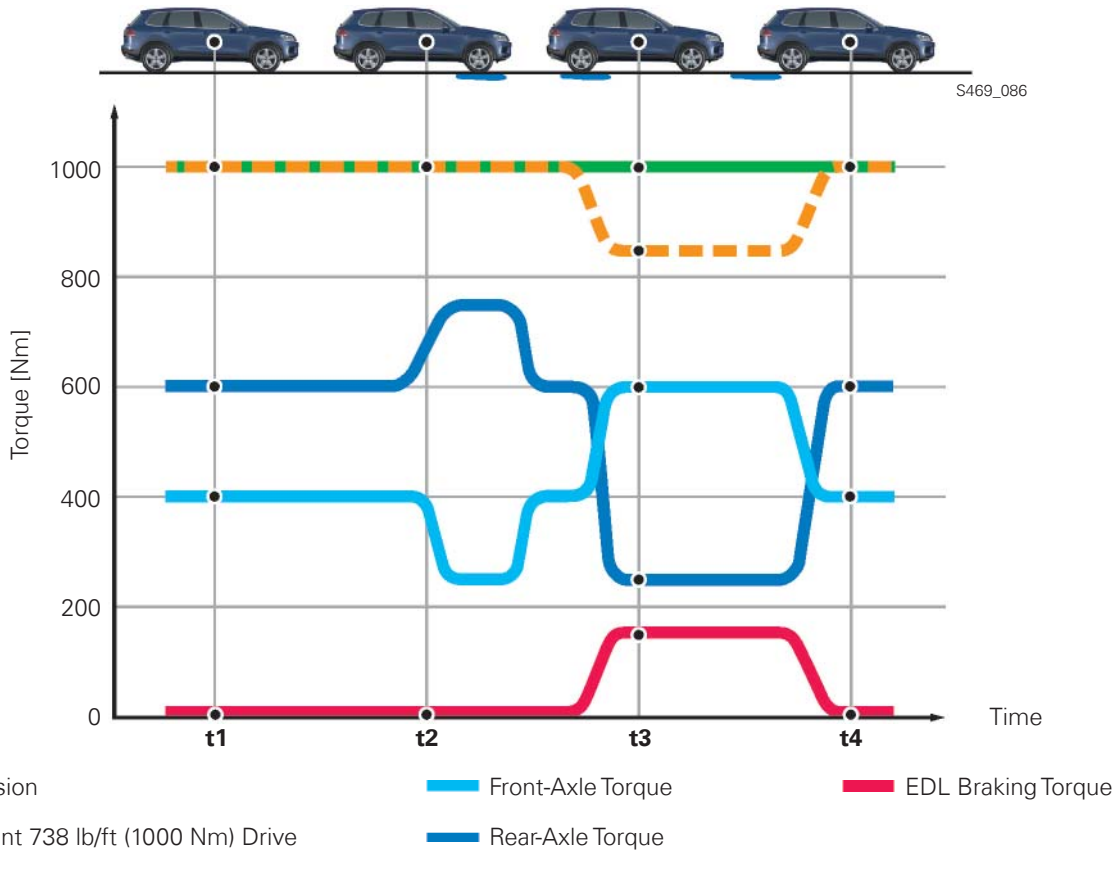
Basically, the center differential reacts to torque changes at the axles. If an axle loses traction, the drive torque within the locking range will immediately be sent to the other axle.

The EDL control system intervenes and ensures traction when necessary.

Transfer Case

Example Torque Distribution

The following example shows how the Touareg reacts to changing road conditions with the self-locking center differential.



In this example, the Touareg drives over a small patch of ice (driving mode t2 and t3) with constant drive power. The slipping limit* is assumed to be 184.5 lb/ft (250 Nm) on each axle. The total drive torque is (t1 and t4) 738 lb/ft (1000 Nm).

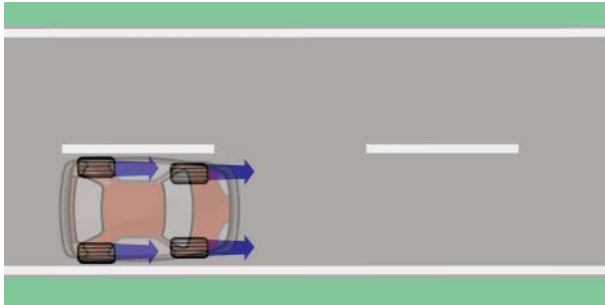
Upon reaching the patch of ice (t2), the front axle loses traction and the drive torque falls to the slipping limit* of 184.5 lb/ft (250 Nm). At the same time, the drive torque at the rear axle rises to 553 lb/ft (750 Nm), due to the locking effect of the differential. Since the distribution of the torque is within the locking range of the differential, there is no speed difference between the axles. 100% of the drive power is converted into propulsion, no intervention is required from the EDL control system.

At the point in time t3, the front axle has already left the patch of ice. Now the rear axle is subject to the reduced frictional value and can only transfer a torque of 184.5 lb/ft (250 Nm). The EDL control system now intervenes to provide support, to ensure optimum traction to the front axle. 85% of the drive power is converted into propulsion.

* maximum transferrable torque of an axle on the ice surface

Transfer Case

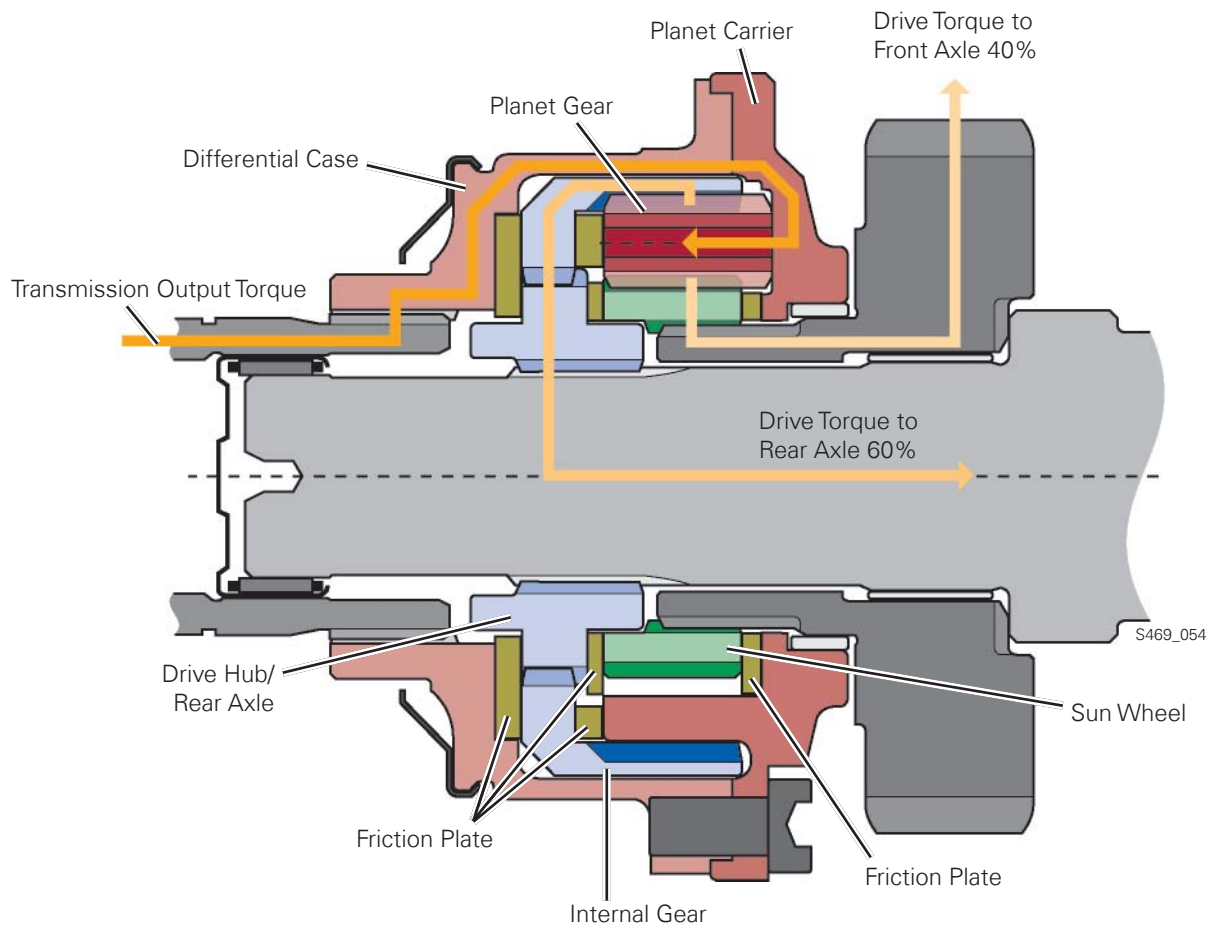
Basic Distribution and Torque Development



S469_056

Driving Situation

All wheels are driving on the same surface and have the same grip.



S469_054

Distribution

When the grip of all wheels is the same, the transmission output torque is distributed between the front and rear axle at a ratio of 40:60.

Torque Development in Differential

The transmission output torque is sent to the differential case via the hollow input shaft. The planet carrier, which is bolted to the case, transfers the transmission output torque to the sun wheel (green) and the internal gear (blue) through the planet gears.

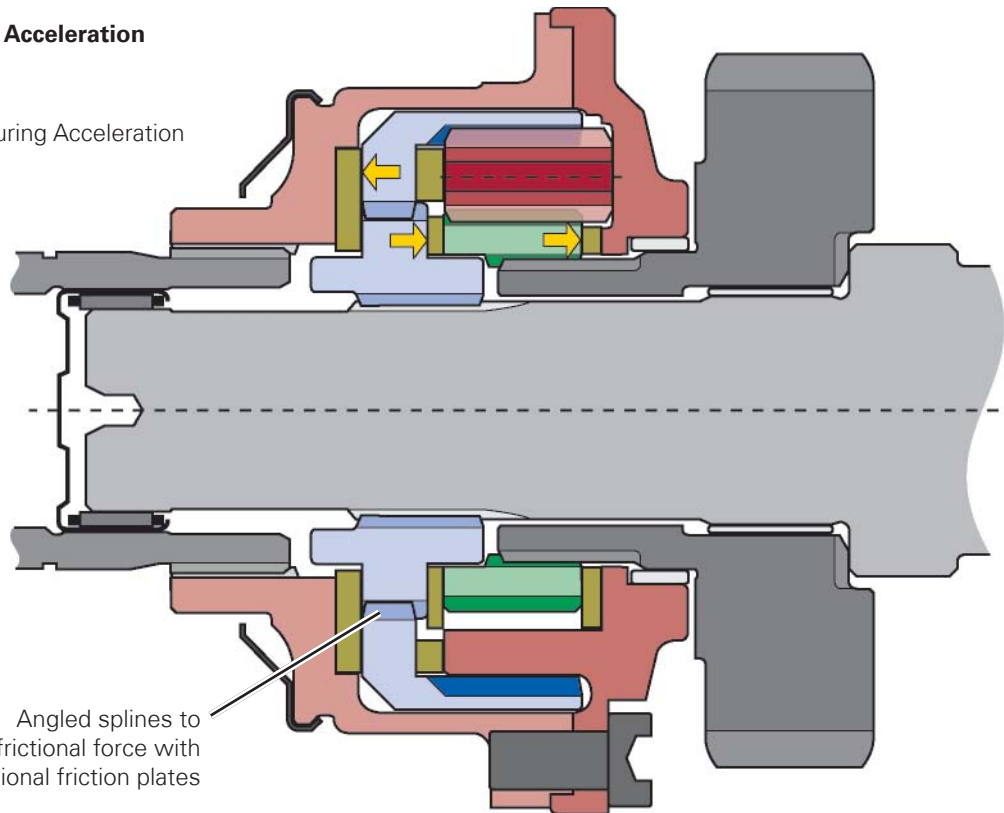
Transfer Case

Axial Force

The axial force is a force that acts in the direction of an axis of a body. The differential gears have defined helical teeth. The drive torque applies an axial force to the gears, which act on various friction plates and produce a frictional torque. The frictional torque then leads to the desired locking effect (locking torque). The size of the locking torque is defined by the locking value. The locking value is the factor of the drive torque is sent to the axle with greater traction.

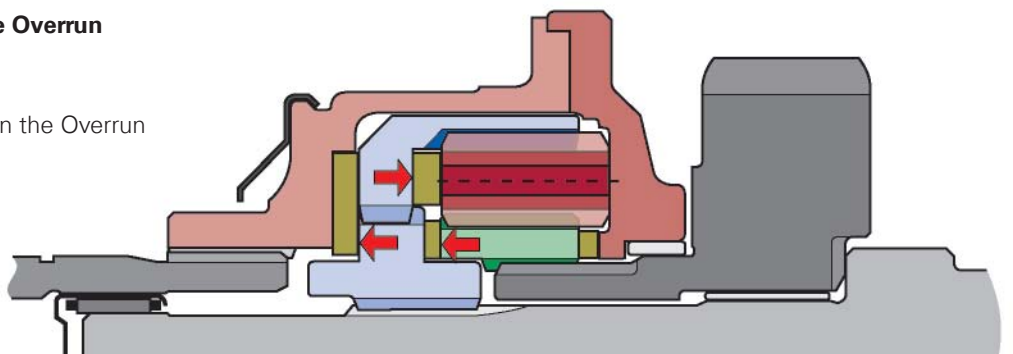
Locking Effect During Acceleration

→ = Axial Force During Acceleration

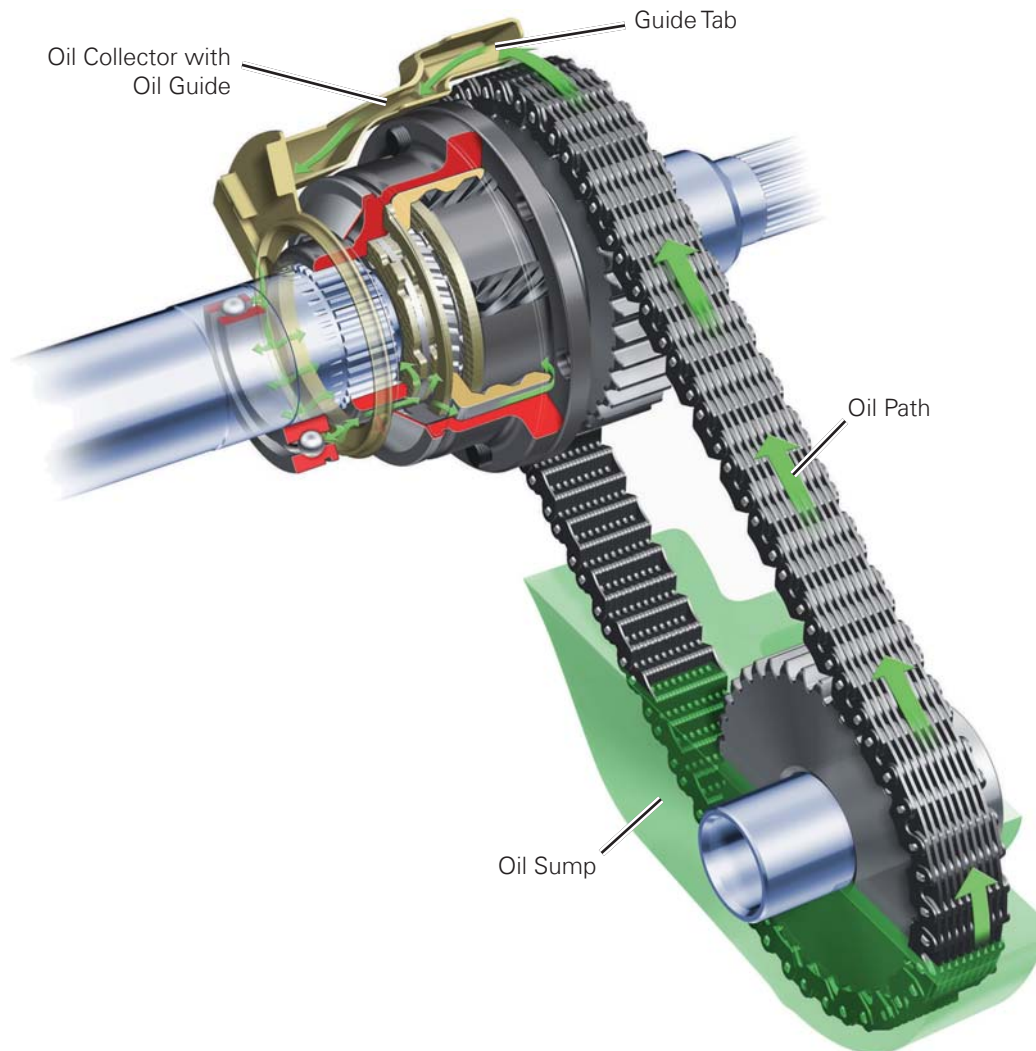


Locking Effect on the Overrun

→ = Axial Force on the Overrun



Lubrication



The OBU transfer case uses ATF oil for lubrication. The upper shafts and the differential are lubricated using an oil collector and special oil guide.

While the vehicle is driven, the chain transports the oil from the oil sump towards the differential, where it is scraped off by the oil collector. The oil guide leads the oil into the differential and onto the input shaft bearing. As soon as the vehicle reaches walking speed, sufficient oil is delivered. The system works in both forward and reverse directions.

An oil circuit is formed by the centrifugal force in the differential. When the vehicle is stationary, this oil circuit breaks up and coats the internal lubricating points. The differential case has been designed so that a certain volume of oil remains when the vehicle is stationary.

Transfer Case

Operating Instructions

Towing:

If the vehicle has to be towed with raised front or rear axle and the wheels of the raised axle cannot turn, exceeding the maximum speed of 31 mph (50 km/h) and maximum towing distance of 19 miles (30 km) can cause internal damage. Also, no gear should be selected.

Brake Test Stand:

A brake test can be performed on a slowly running test stand (up to 3.5 mph (5.5 km/h)). The wheels must be driven by the test stand. No gear can be selected and the differential lock (if equipped) cannot be engaged.

Output Test Stand:

Only a 4-wheel roller dynamometer may be used for the output test.



A constant high speed difference between the front and rear axle combined with a high load will damage the center differential.

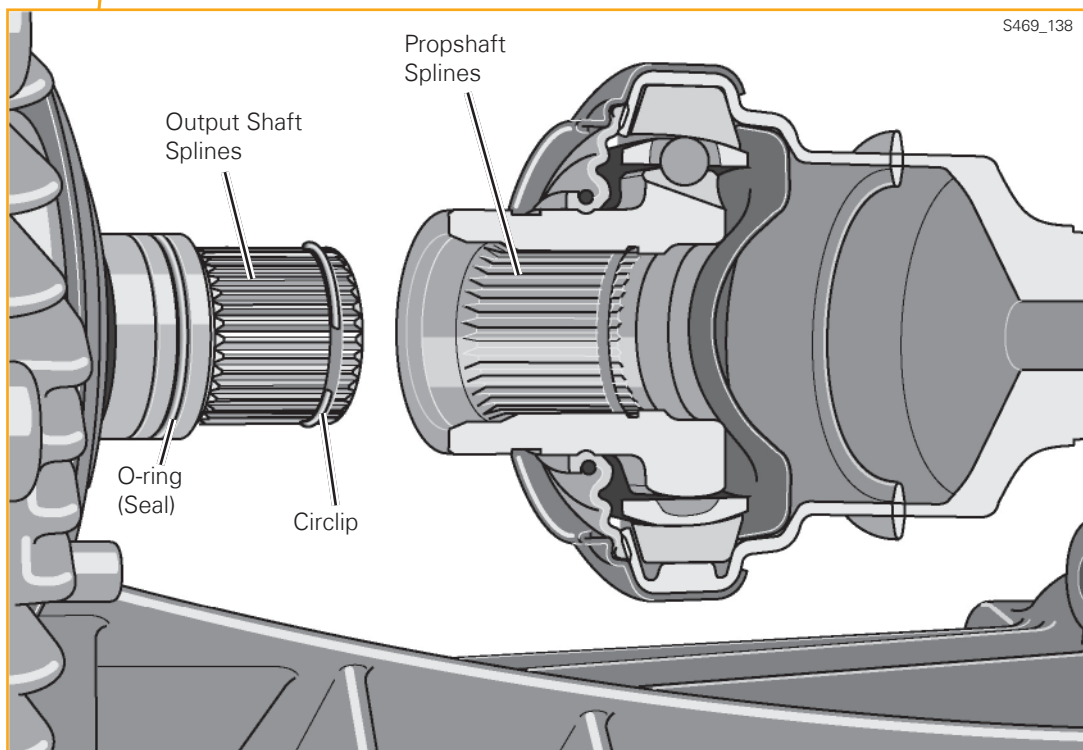
The self-locking center differential cannot be compared with a 100% mechanical differential lock. If an axle or a wheel spins without power, there is no drive. This spinning is controlled by the EDL system.

Splines on Driveshafts



S469_075

The driveshafts on the Touareg have been changed. They have been designed with splines to save weight. The splines are locked onto the output shaft of the transfer case with a circlip (0BV/0BU).



S469_138



The circlip and seal need to be replaced before the driveshaft is installed.



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Knowledge Assessment

An on-line Knowledge Assessment (exam) is available for this Self-Study Program.

The Knowledge Assessment may or may not be required for Certification.

You can find this Knowledge Assessment at:

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For Assistance, please call:

Volkswagen Academy

Certification Program Headquarters

1-877-791-4838

(8:00 a.m. to 8:00 p.m. EST)

Or, E-mail:

concierge@volkswagenacademy.com



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March 2013

