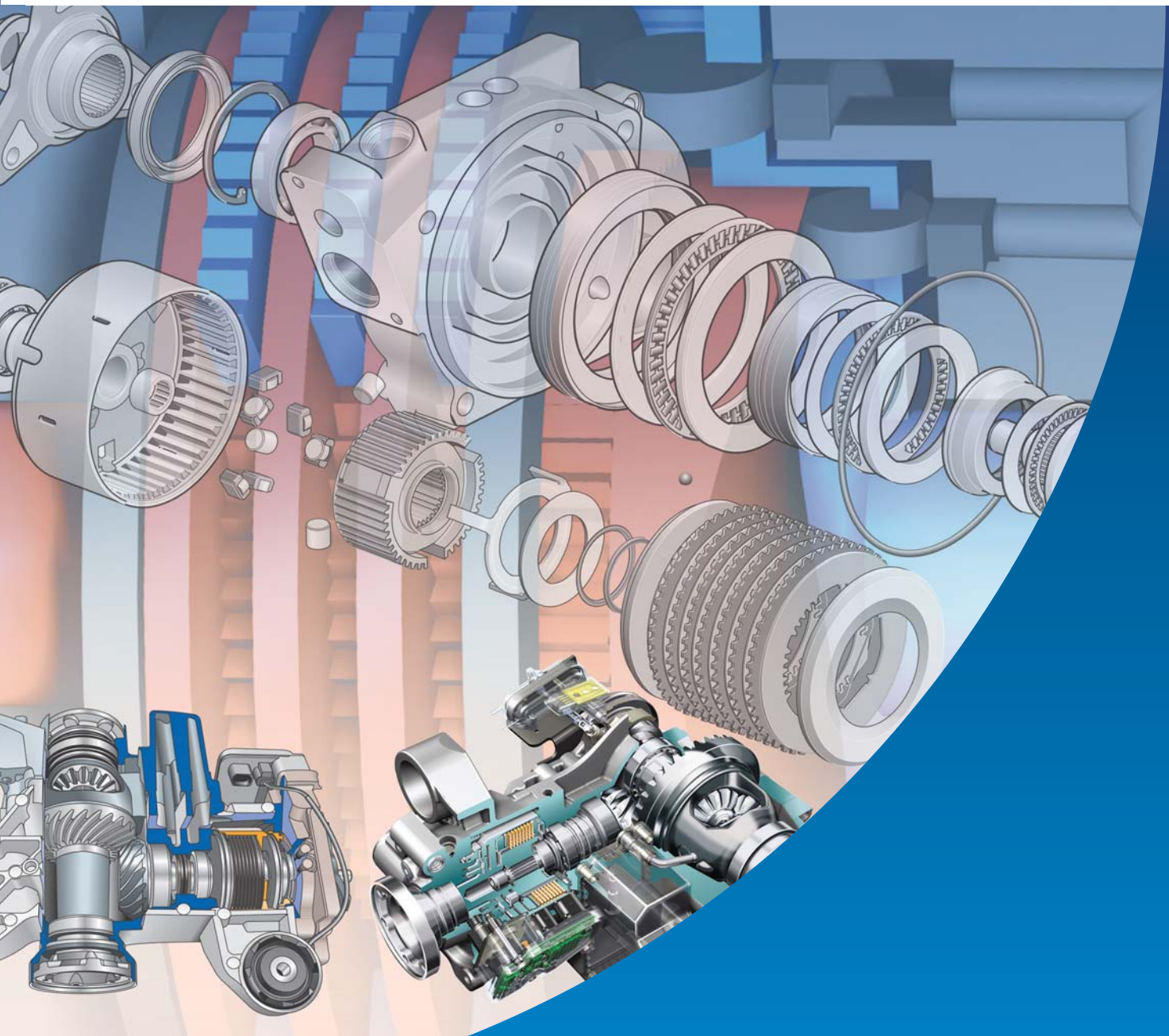




Self-study Programme 333

4MOTION with Haldex Coupling Model Year 2004

Design and Function



4MOTION Drive with Haldex Coupling Model year 2004 will initially be used in the Golf 2004 and in the Transporter 2004.

Repair and servicing have been made easier compared with the previous version of the Haldex coupling.

The new Haldex coupling is fitted onto the rear axle gearbox so that no adjustments are necessary. The electrical control of the regulating valve has been reconfigured. The oil filter for the Haldex coupling is now a fleece filter.



S333_091



For information on the first generation of the Haldex coupling, please refer to self-study programme 206 “Four-Wheel Drive with Haldex Coupling”.

For the previous four-wheel-drive system, please see self-study programme 78 “Golf syncro”.

The general function of Visco and Haldex coupling is also explained in the multimedia training course “Power Transmission 2 – Automatic Variable Gearbox – Mechanics”.

NEW



Important Note



**The self-study programme shows the design and function of new developments.
The contents will not be updated.**

For current testing, adjustment and repair instructions, refer to the relevant service literature.



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4MOTION Drivetrain	6
Haldex Coupling	18
Rear Axle.....	41
Differential Lock	42
Service	47
Test Yourself.....	48



Brief Overview



Four-wheel Drive

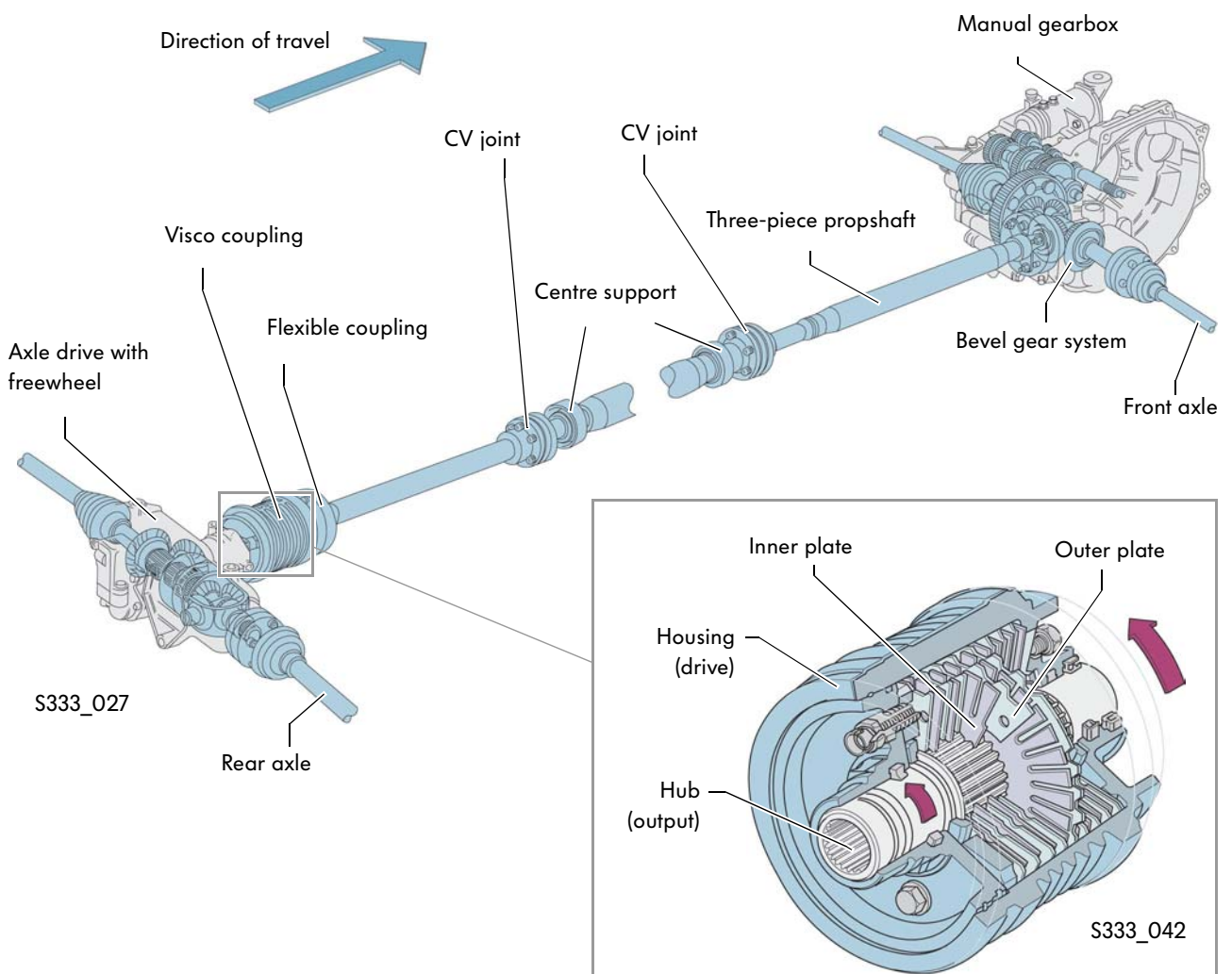
There is a long tradition of four-wheel drive vehicles at Volkswagen – even without taking the four-wheel drive systems on the Ittis and vehicles with air-cooled engines into consideration.

The drivetrain from the Syncro four-wheel drive system with Visco clutch has developed into the 4MOTION drive with Haldex coupling. The Visco coupling was last used in the predecessor to the Transporter 2004.

Since 2004, the Transporter 2004 and the Golf 2004 have been available with 4MOTION drives and a second generation Haldex coupling.

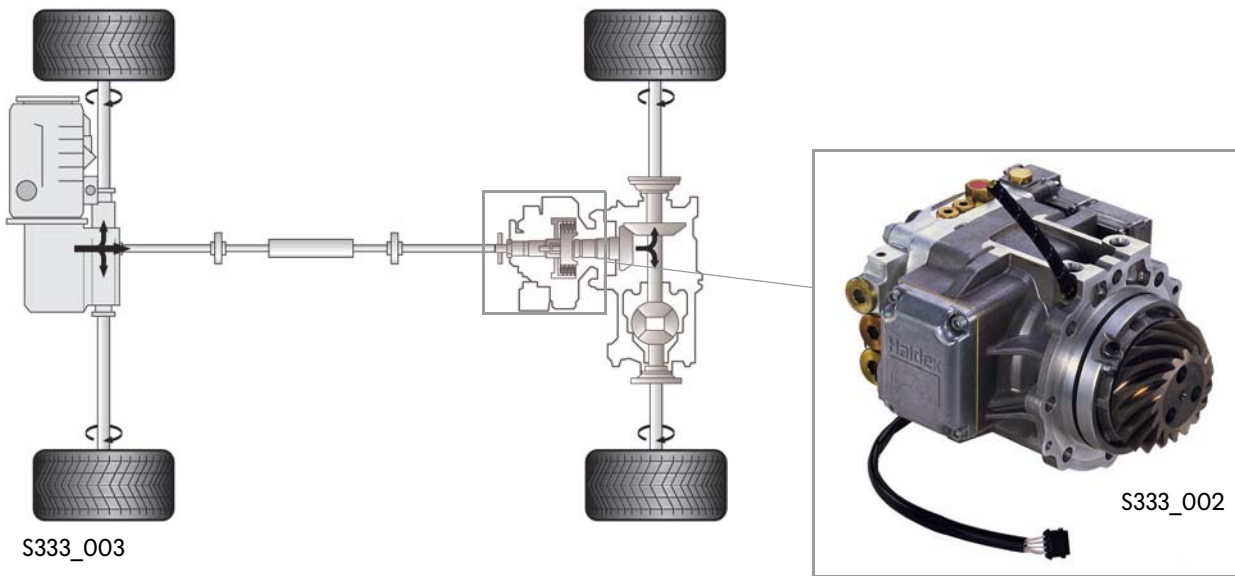
Syncro four-wheel drive with Visco coupling

The arrangement of the components in the drivetrain has only changed slightly over the years. The Visco coupling was not electronically controllable. A freewheel had to be added to achieve the ABS functions.



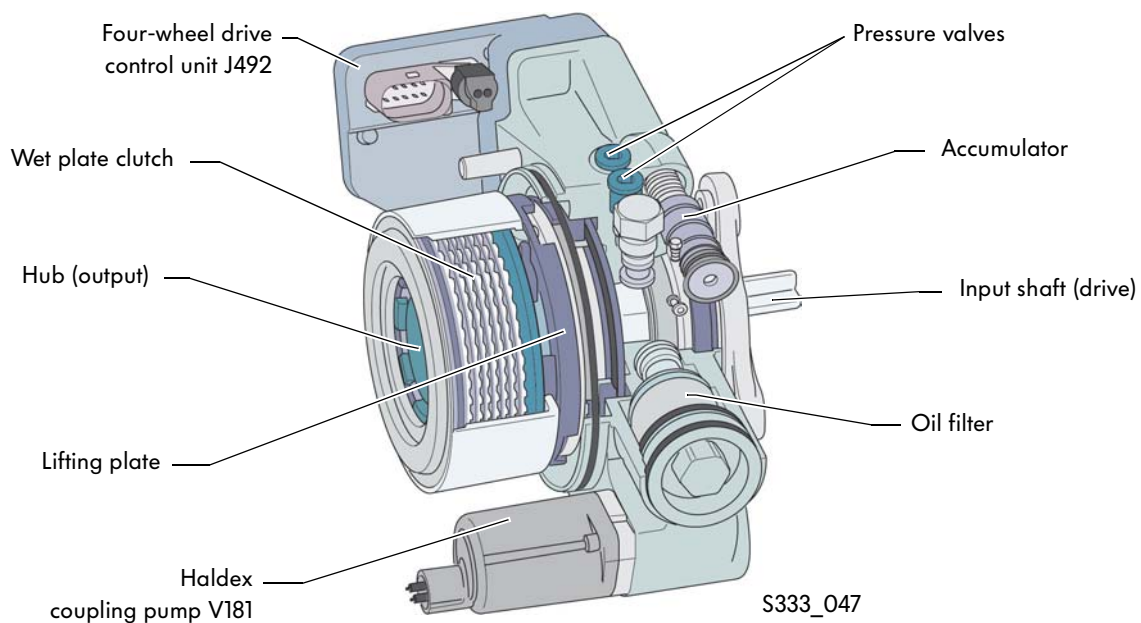
First generation 4MOTION drive with Haldex coupling

The advantage of the Haldex coupling compared with the Visco coupling is that torque transfer can be controlled depending on the driving situation. A freewheel to make the system ABS compatible is no longer required.



Haldex coupling model year 2004

The Haldex coupling works in exactly the same way in both generations. There have been several improvements to the design. The configuration of the electrical and hydraulic components has also been changed.



4MOTION Drivetrain

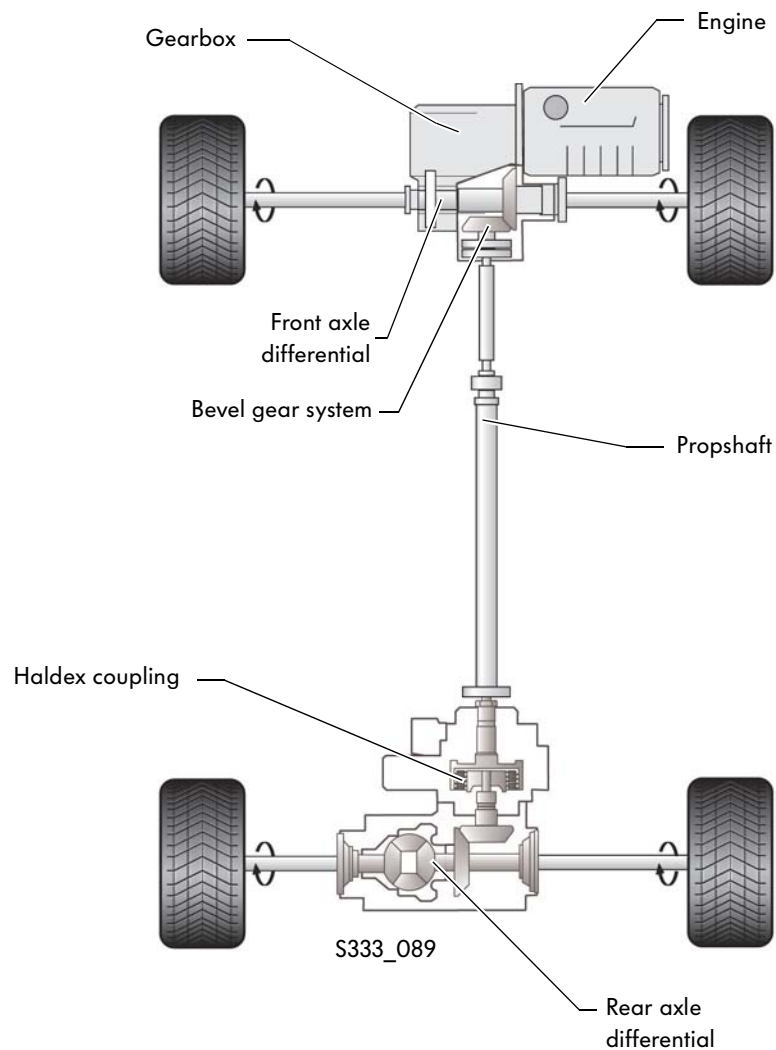
Overview

The front wheels are driven via the front axle differential as in a conventional system. The rear axle is driven via a flanged bevel gear system connected to the front differential cage.

The power is transmitted via the propshaft and the Haldex coupling to the rear-axle drive.

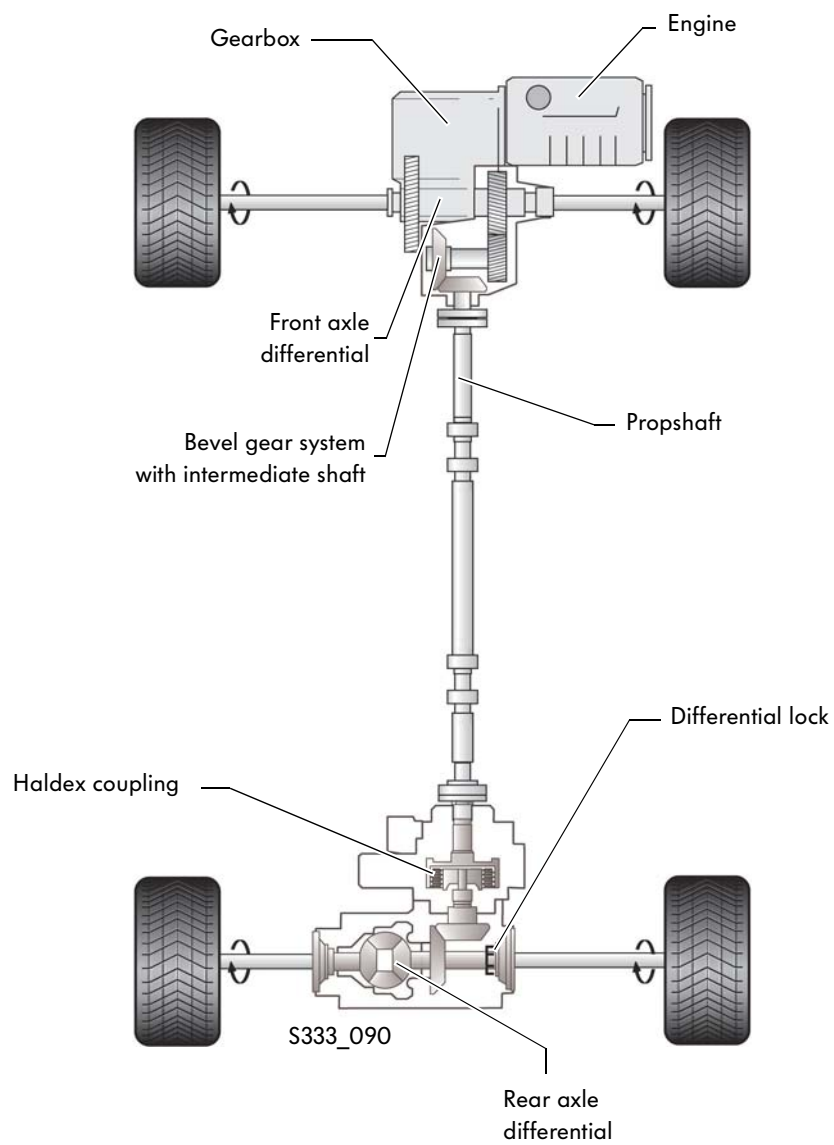


4MOTION drivetrain in Golf 2004





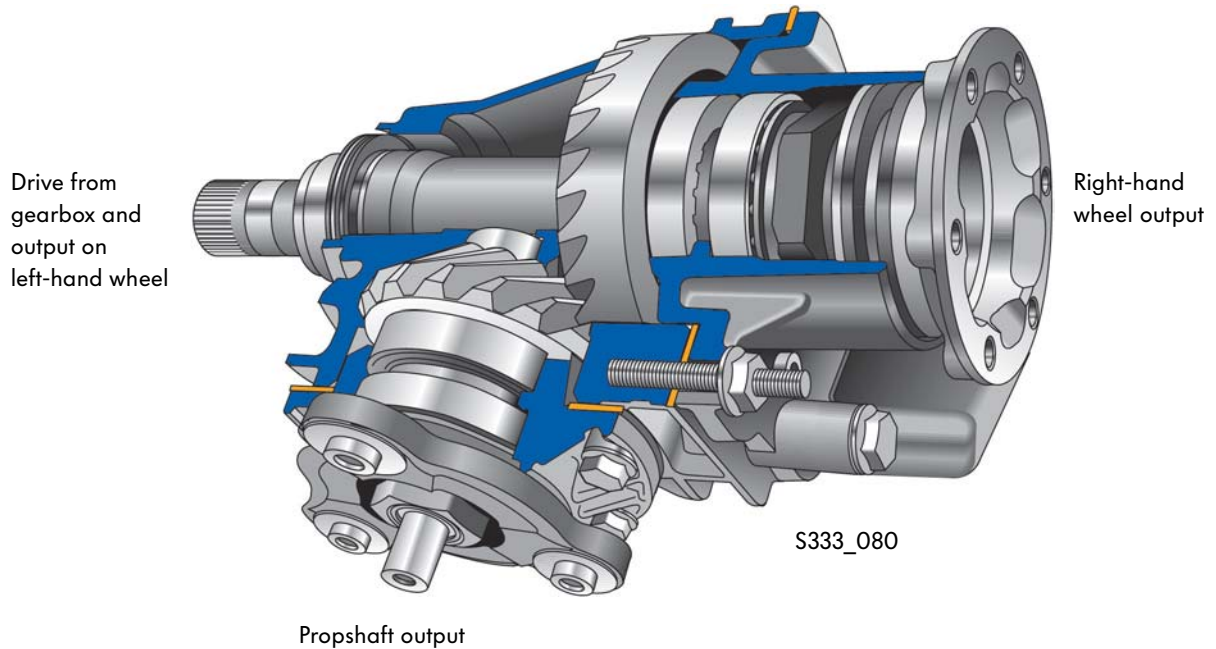
4MOTION drivetrain in Transporter 2004



4MOTION Drivetrain

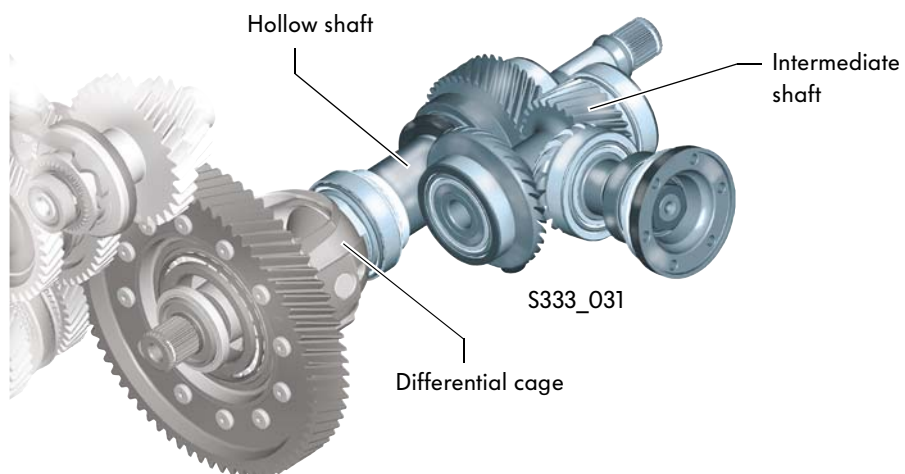
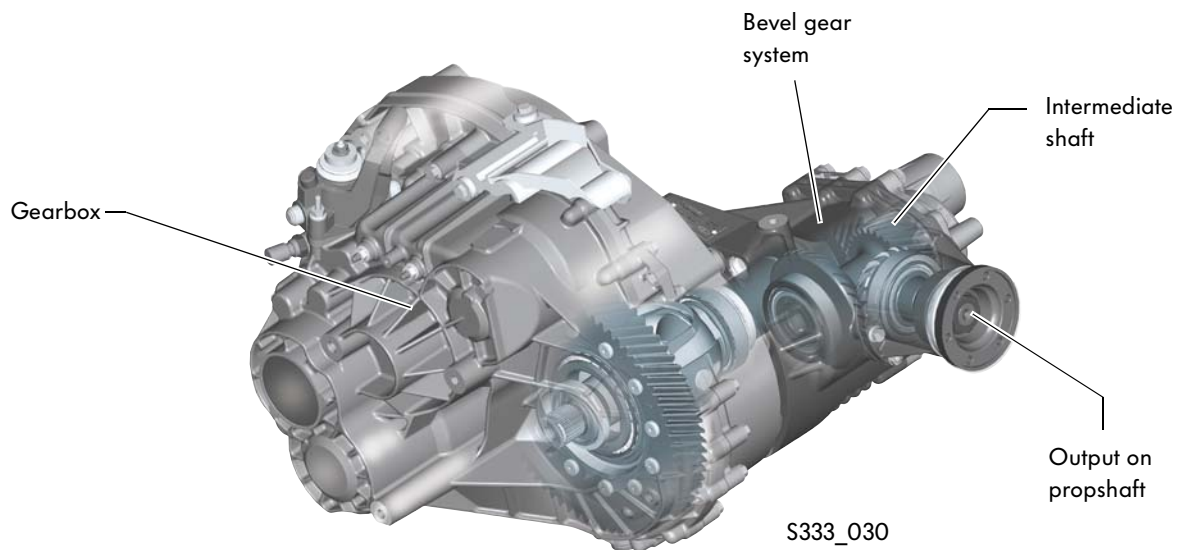
Bevel gear system in the Golf 2004

The bevel gear system in the Golf 2004 transfers the power to the propshaft with a transmission ratio of 1.6. This allows a shaft with a smaller diameter to be used because it has to transfer less torque. In the rear axle differential, the engine speed is then reduced again by the same factor.



Bevel gear system with intermediate shaft in Transporter 2004

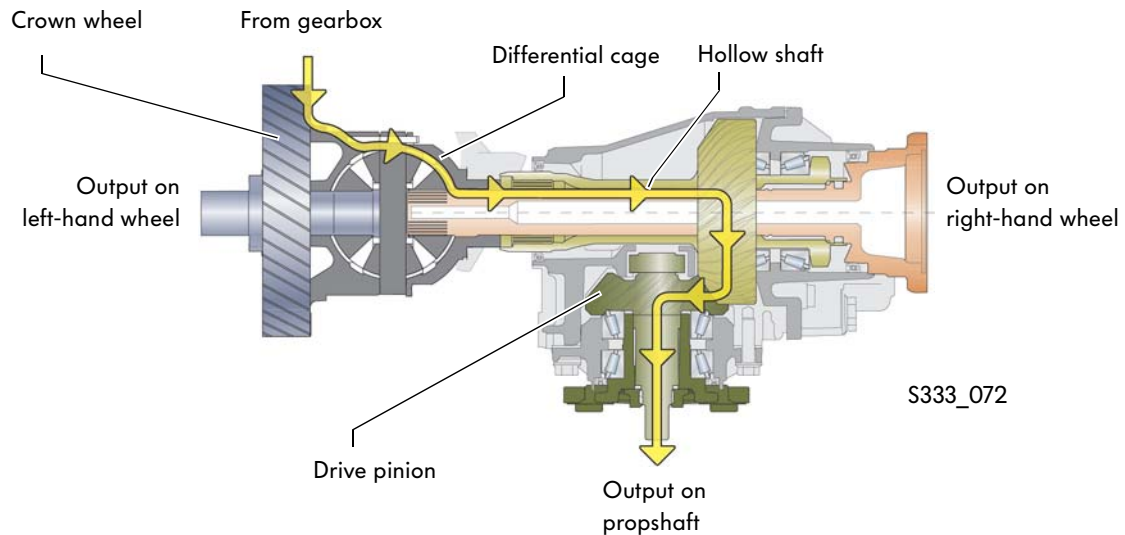
Due to the higher torques being transferred, the transmission factor for the Transporter is 2.5. Therefore an intermediate shaft is used. In the rear axle differential, the ratio is stepped up again to the front axle speed.



4MOTION Drivetrain

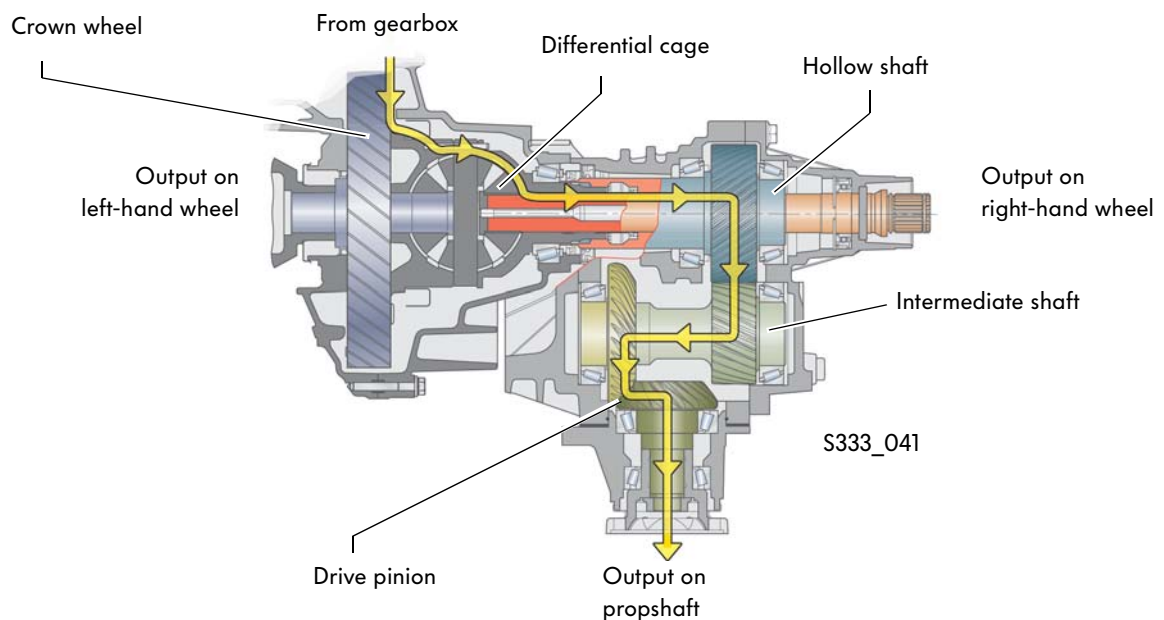
Power transmission in the Golf 2004

The power is transferred from the crown wheel via the differential cage, the hollow shaft and the drive pinion to the propshaft.



Power transmission in Transporter 2004

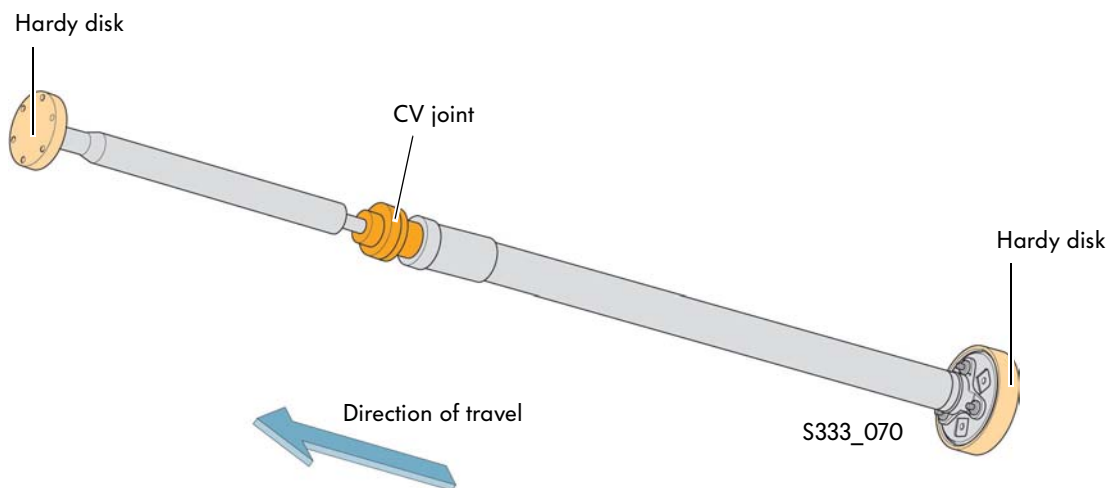
The power is transferred to the hollow shaft from the crown wheel via the differential cage. The differential cage and hollow shaft then form a positive connection. From the hollow shaft, the output power is transferred to the intermediate shaft and then to the propshaft via the drive pinion.



Propshaft

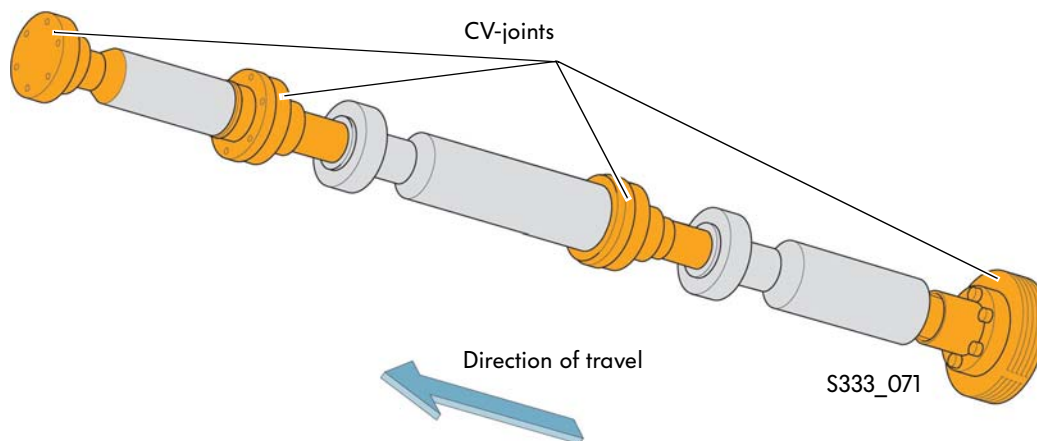
Golf 2004

The propshaft for the Golf 2004 has two Hardy disks and a CV-joint.



Transporter 2004

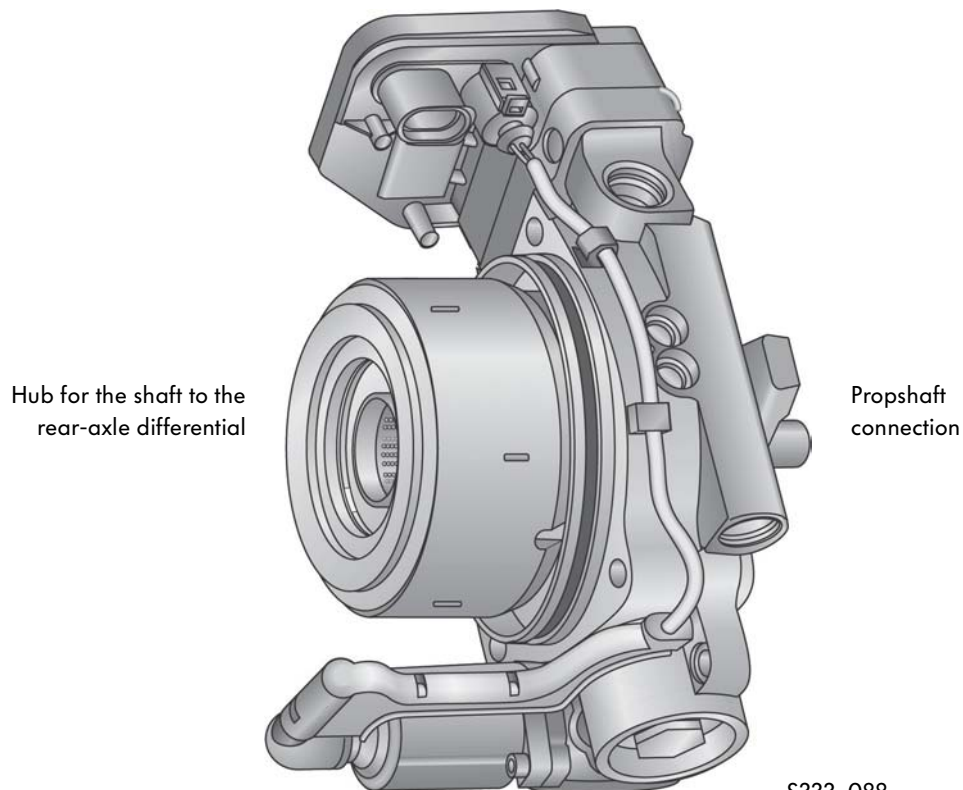
The propshaft for the Transporter 2004 is split into three sections by four CV-joints. Due to the length of the propshaft, it has to be mounted on bearings along the body. The working angles on the propshaft are therefore greater. This means CV-joints that can run at greater working angles are required.



4MOTION Drivetrain

Haldex Coupling

The Haldex coupling is located on the propshaft in front of the rear axle differential. It engages at an engine speed of 400 rpm. The transferred torque is regulated by the control unit so that there is no slip in the coupling when the vehicle is travelling in a straight line. This occurs via the clamping load of the clutch plate set inside the Haldex coupling. The Haldex coupling has a similar design for the Golf 2004 and the Transporter 2004. The number of plates used in the Haldex coupling and the connection to the different propshafts are different in the two vehicles.



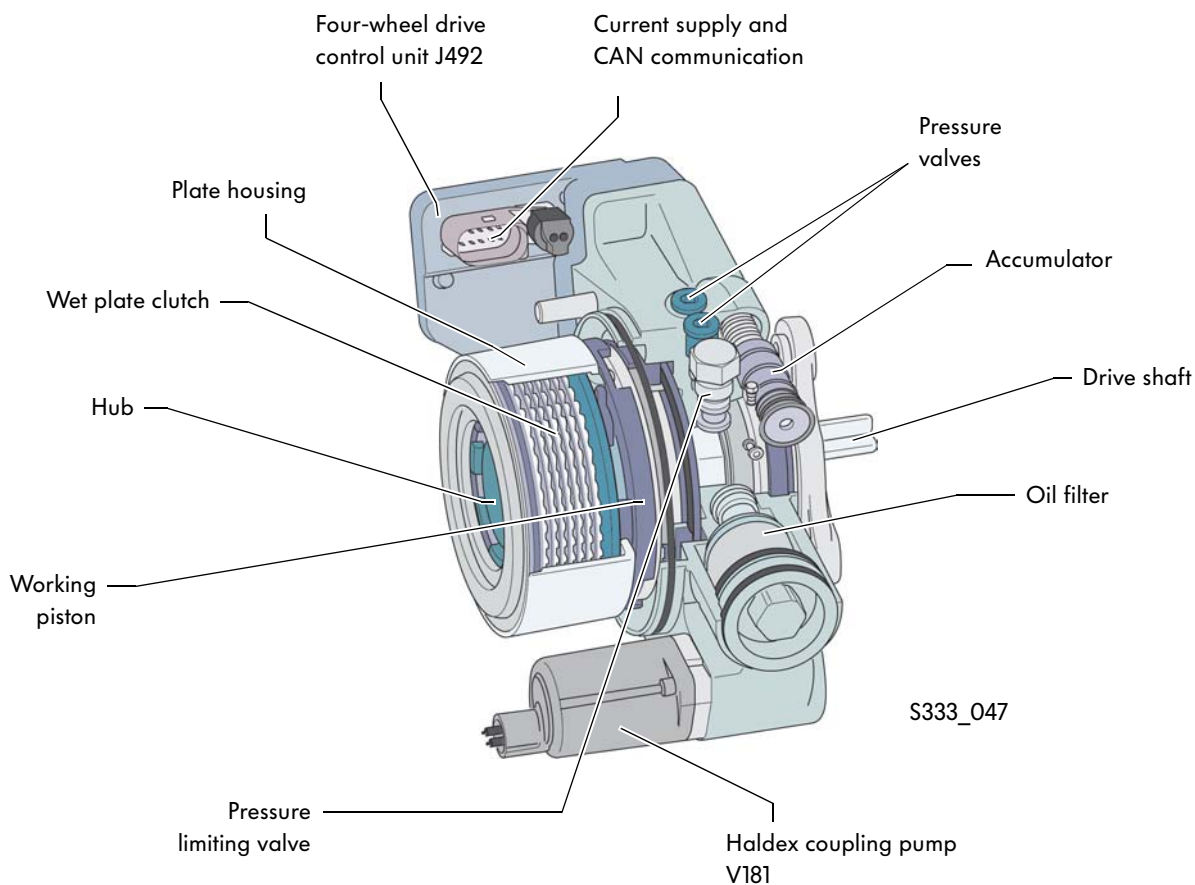
New features on Haldex coupling model year 2004

Changes to the Haldex coupling model year 2004 compared with the previous model:

- The Haldex coupling can be replaced as a unit. There is no need for complicated adjustments after replacement as the drive pinion in the rear-axle differential is no longer replaced, instead it remains in the housing.
- A proportional hydraulic valve takes care of hydraulic control instead of the electrical control valve previously used.
- In addition to the temperature, the oil pressure is also measured with a double sensor.
- The paper filter has been replaced with a maintenance-free fleece filter.
- The Haldex coupling is integrated in the rear-axle drive.
- The oil volume has been increased. This has extended the oil change intervals.



Overview of components for Haldex coupling model year 2004



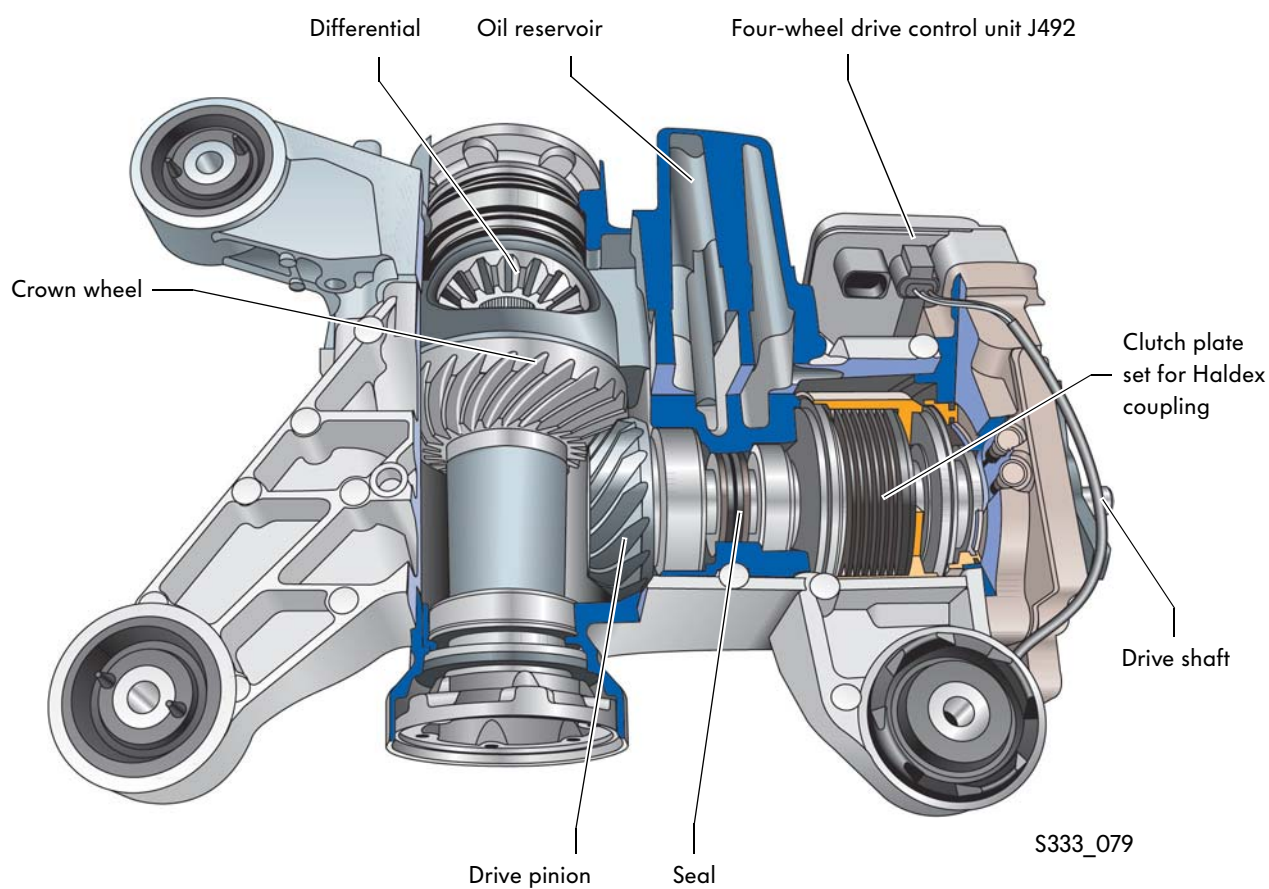
The suction valves are located under the oil filter.

4MOTION Drivetrain

Rear Axle Drive

Golf 2004

A differential lock is not used in the Golf 2004 4MOTION. The transmission ratio is 1.6.

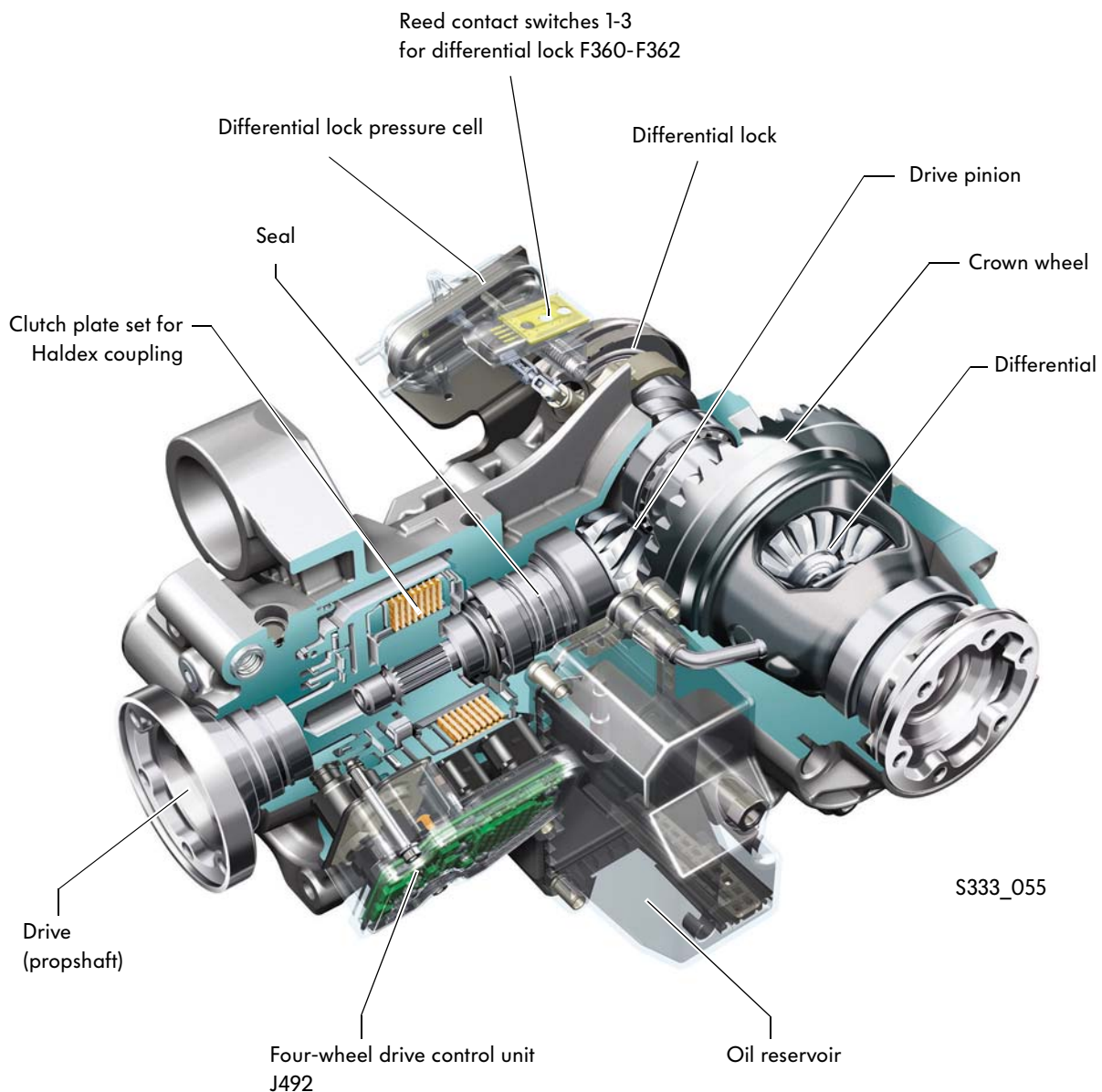


Transporter 2004

The 4MOTION rear-axle drive for the Transporter 2004 consists of the Haldex coupling, the rear-axle differential and the optional differential lock. The transmission ratio is 2.5.

There are the following differences in the design of the rear-axle drives for the Golf 2004 and the Transporter 2004:

- No optional differential lock for the Golf 2004
- The rear-axle differentials have different transmission ratios
- Different oil reservoirs
- Different connection to the axle
- Different number of plates in the Haldex coupling



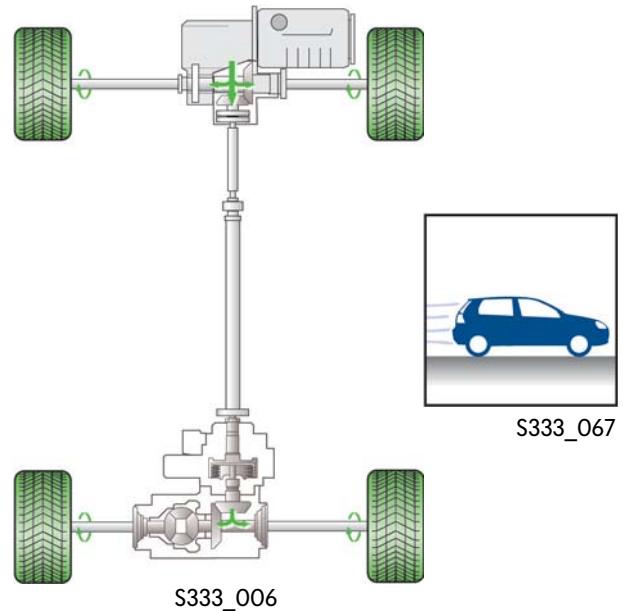
4MOTION Drivetrain

Driving situations

The powerful system of the 4MOTION drivetrain stabilises the vehicle together with the ESP in almost all driving situations. The following paragraphs explain how a vehicle with Haldex coupling works without the use of other electronic systems (e.g. EDL).

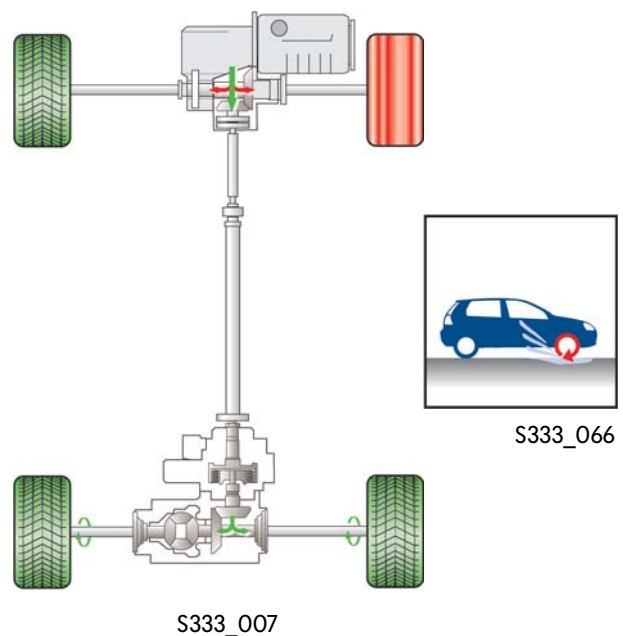
Normal acceleration

Even during normal acceleration, there are speed differences between the front and the rear axle (approx. 1-2 rpm), which are sufficient to close the Haldex coupling and therefore cause the power to be transferred to all four wheels.



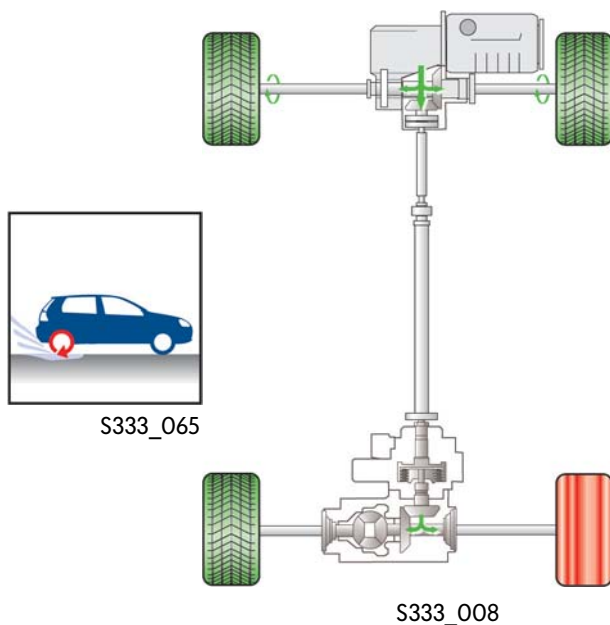
100% slip on one front wheel

If there is 100% slip on one of the front wheels, the whole driving power is transferred to the rear axle. The differential balances out torque differences between the two front wheels. That means that momentum cannot be transmitted to the road by the other wheel when there is 100% slip on one wheel.



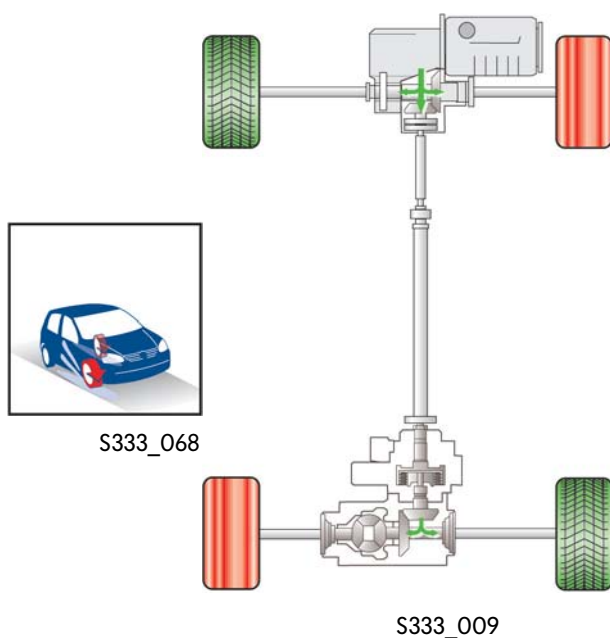


100% slip on one rear wheel



In this case too, there are different speeds on the front and rear axles. The positive connection to drive all four wheels is formed. The rear axle is driven, however, due to the slip on the rear wheels, no driving power can be transferred to the road. The front axle therefore takes over driving.

100% slip on one wheel at the front and one at the rear



In theory, propulsion is not possible in this situation: There is no driving power at any of the wheels due to the power distribution of the axle differentials.

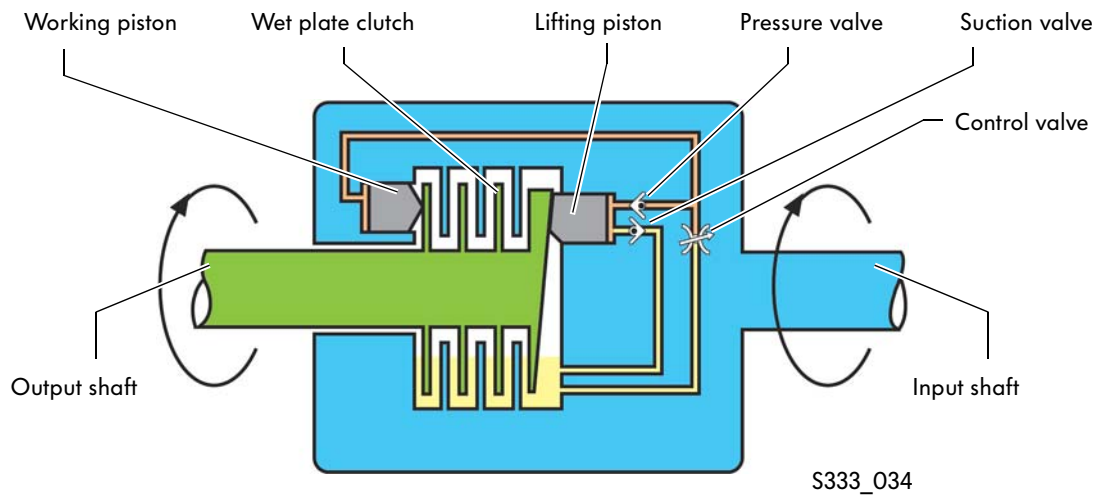
On the Golf and the Transporter, however, the four-wheel EDL intervenes here and ensures propulsion with the other wheels.

The wheels that are slipping are braked and the tractive force is transmitted to the wheels via the differential with a greater positive engagement potential.

Haldex Coupling

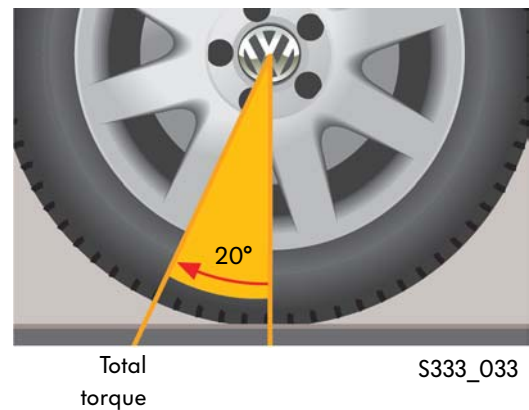
Haldex coupling design

The 4MOTION system features a second-generation Haldex coupling in both the Golf 2004 and the Transporter 2004. Here is a schematic diagram.

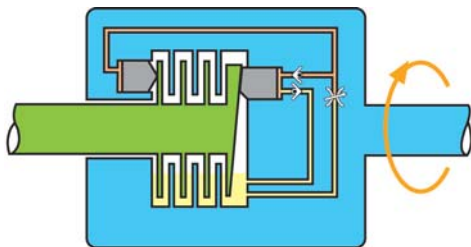


Response of Haldex coupling model year 2004

The clutch plate set for the Haldex coupling can transfer torque once there is approx. 10° wheel turning angle difference between the axles. The total torque can be transferred once the wheel turning angle reaches 20° .

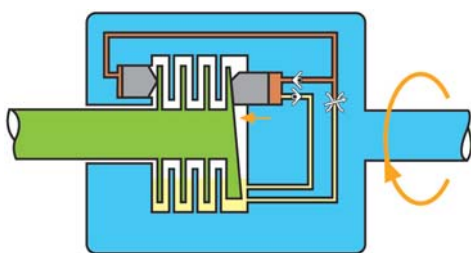


General functioning of Haldex coupling



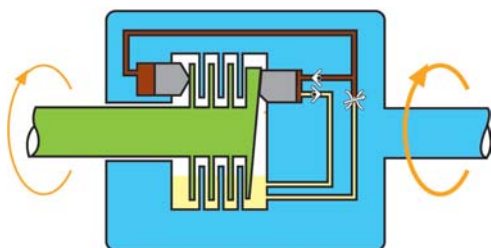
S333_035

As soon as there are different wheel speeds, the input shaft turns with the actuating roller of the lifting piston around the lifting plate connected to the output shaft that is rotating at a lower speed.



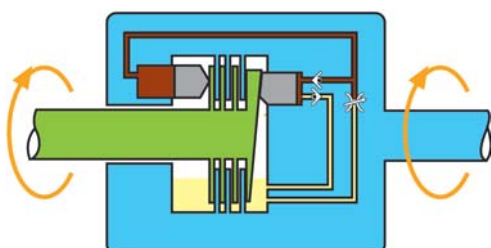
S333_036

The roller transfers these up and down movements to the lifting piston. The lifting piston is made to move upwards and builds up a flow.



S333_038

The flow is diverted to the working piston via an oil channel. The working piston is pushed to the right against the actuating rollers of the working piston and the thrust washer on the clutch plate set.



S333_039

The clutch plate set is pushed together. The coupling input shaft and output shaft are connected and all four wheels are thus driven. The torque can now be transferred.

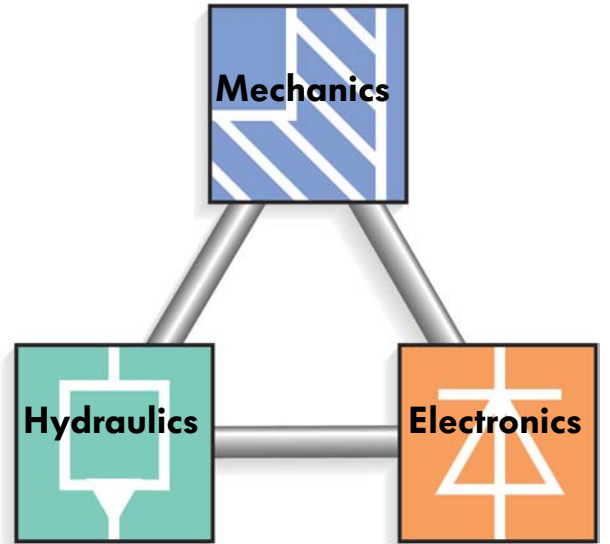


Haldex Coupling

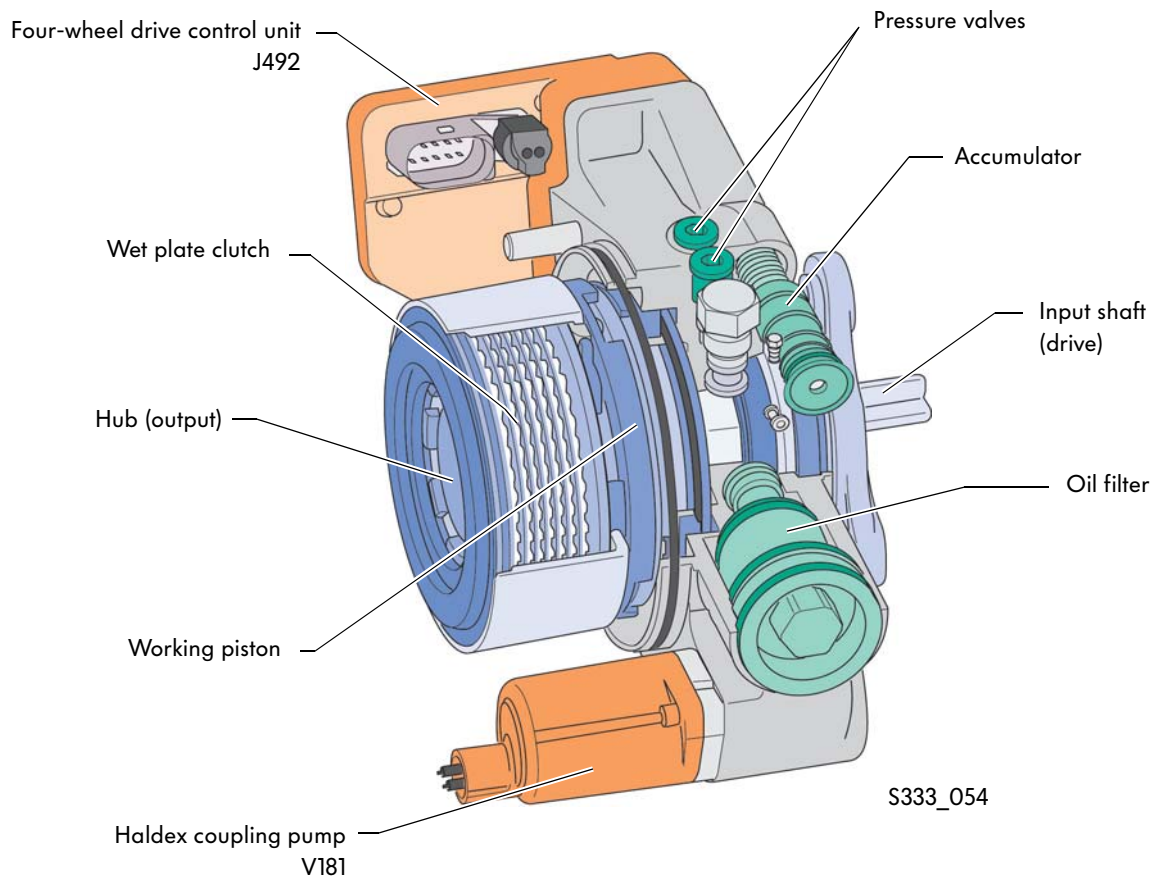
Main Components of Haldex Coupling Model Year 2004

The Haldex coupling consists of three different component systems:

- mechanical components,
- hydraulic components and
- electronic (and electrical) components.



S333_004

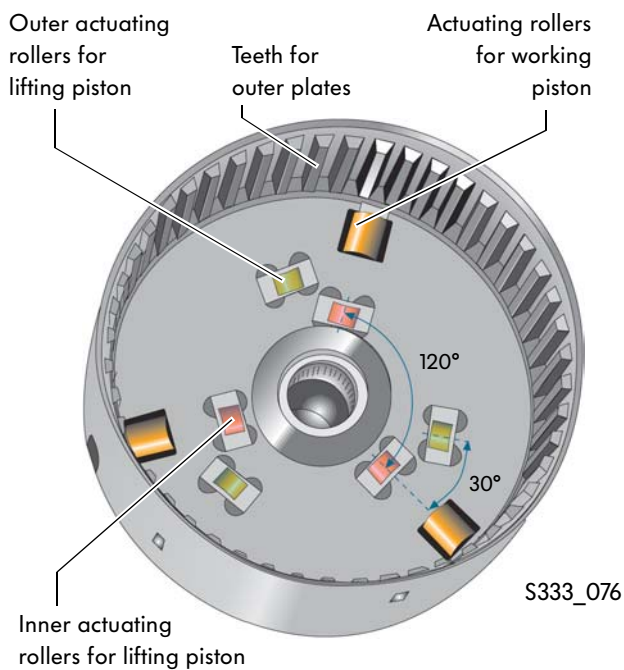


S333_054

Mechanical components

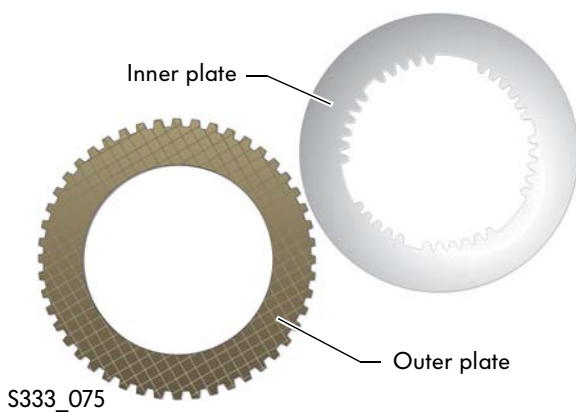
The mechanical parts include the Haldex coupling drive with the coupling cage and the outer plates that mesh inside it as well as the lifting plate on the output hub with the inner plates that mesh inside it. The working pistons still belong to the mechanical components.

You will find an overview of all mechanical components on the following double page.



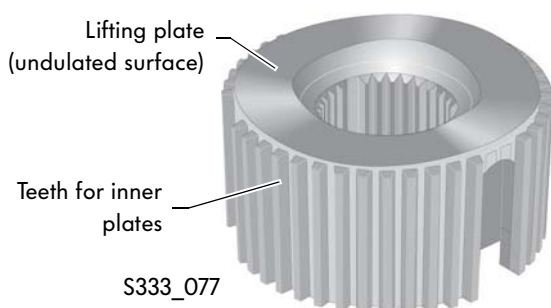
The pump effect is transferred to the lifting pistons by the actuating rollers. We distinguish between the outer lifting piston with the three outer actuating rollers and the inner lifting piston with the three inner actuating rollers. The actuating rollers for the lifting pistons are arranged offset at an angle of 120°. This offset allows three lifting motions per revolution. The lifting pistons work at an angle of approx. 30° to provide a higher pressure over a longer period. This improves the response.

The three actuating rollers for the working piston, which press the clutch plate set together when the working pressure is reached, are also arranged at an angle of 120°.



The outer plates (friction plates) are connected to the coupling housing via their outer teeth.

The inner plates are fitted inside on the output hub and have teeth on the inside. They are made from steel.

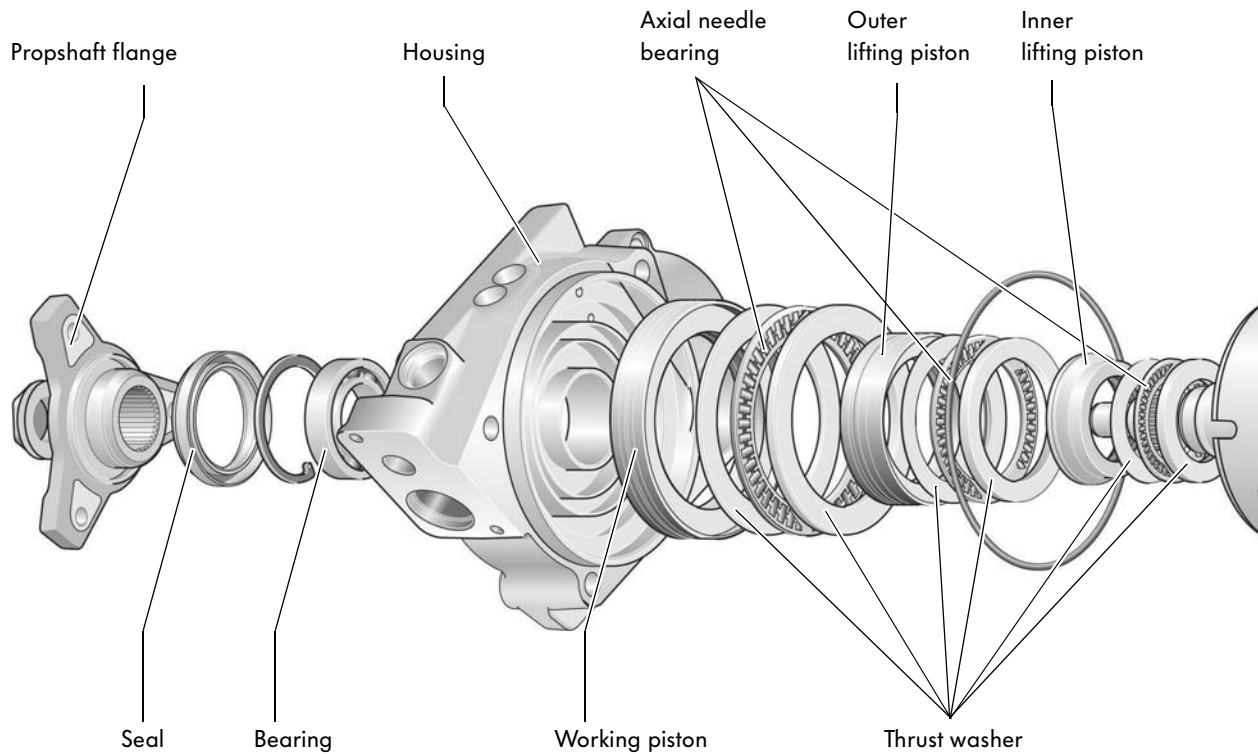


The lifting plate on the output hub has an undulated surface over which the lifting pistons run to produce the pumping effect.



Haldex Coupling

Overview



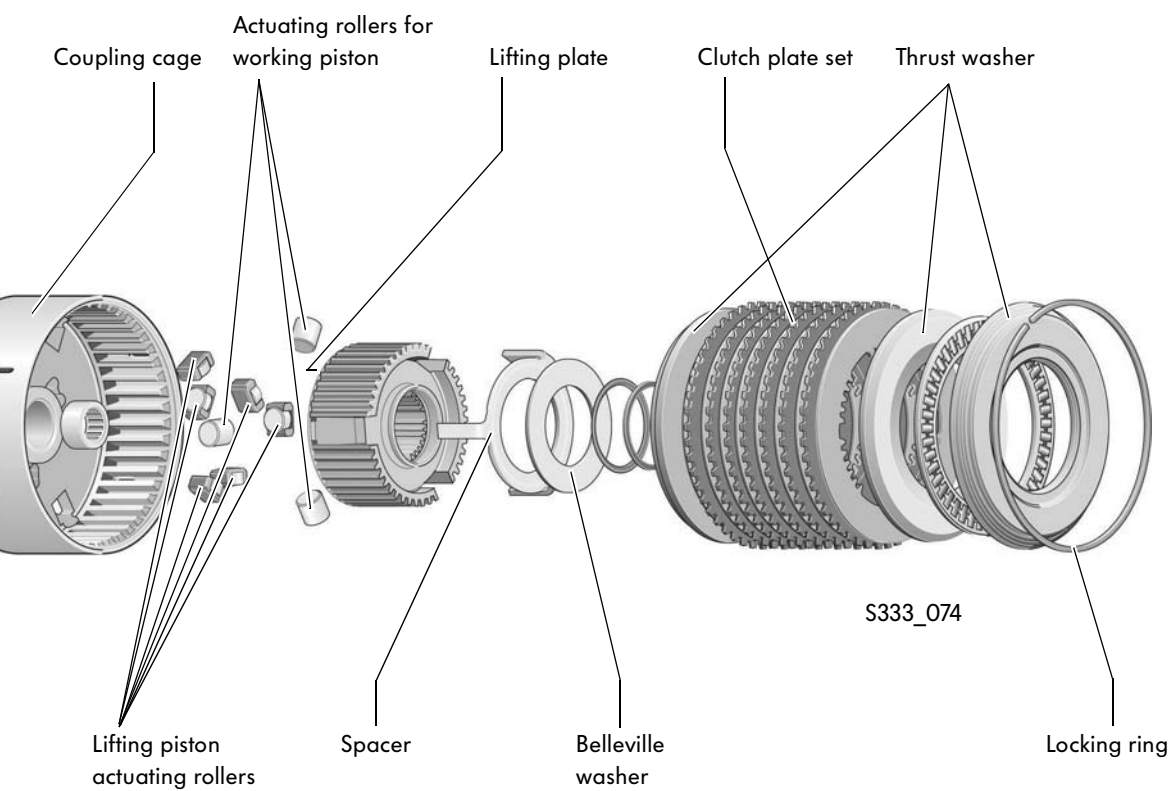
This exploded view will help explain the functions and connections.

The working piston and the two lifting pistons are all annular pistons.

If there is a difference in speed, the lifting plate with its undulated surface runs over the lifting piston rollers. The lifting pistons are thus moved and generate pressure. This pressure acts on the working piston. The working piston transfers the pressure to the actuating roller for the working piston. This acts on the thrust washer for the clutch plate set so that the plates are pressed together.



For information on separately available genuine parts, please see the ETKA electronic parts catalogue.



To maintain minimum friction while the clutch is open, the clutch plate set is spread as long as no pressure is generated by the pump effect of the lifting piston.

Haldex Coupling

Hydraulic components

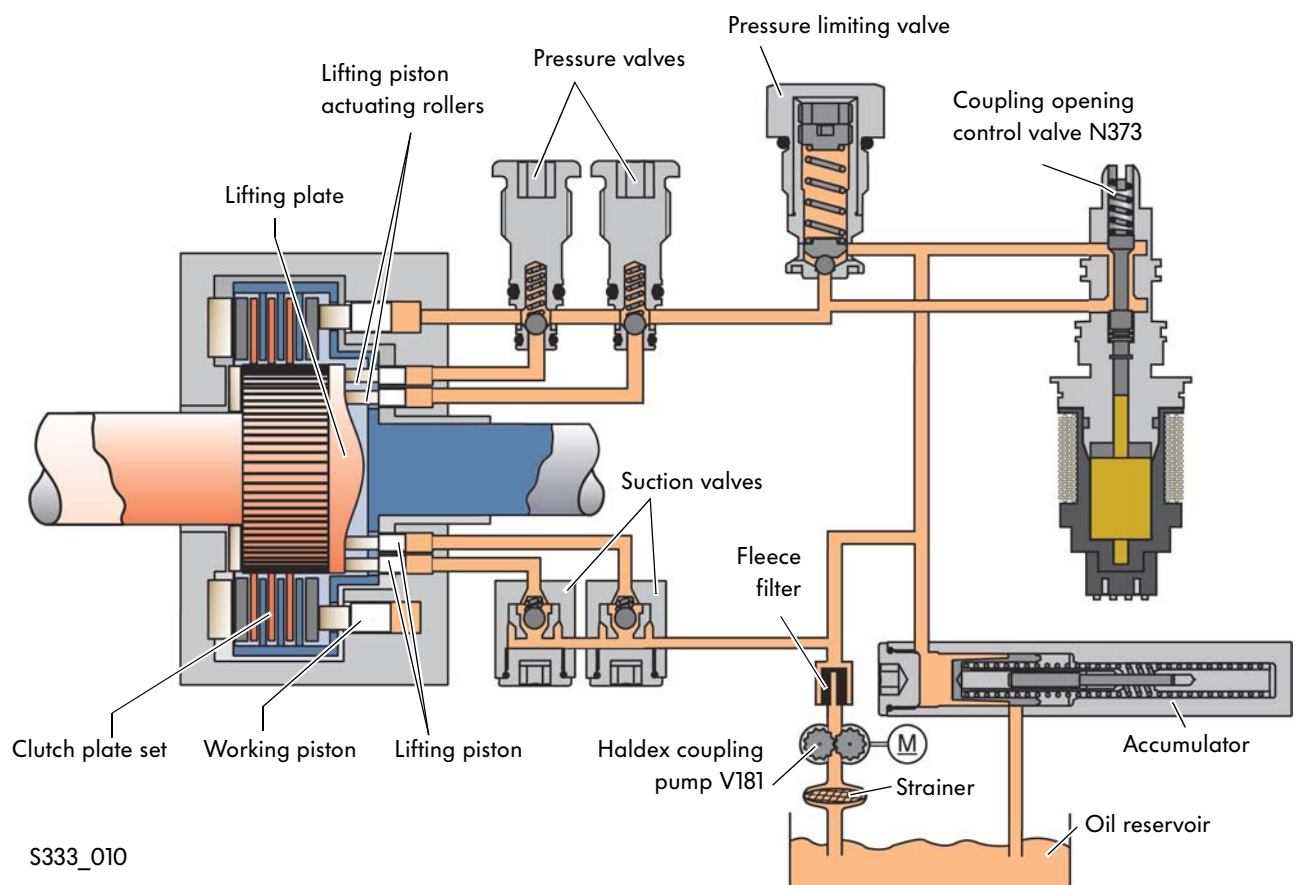
The hydraulic components include the valves and the accumulator. The hydraulic system of the Haldex coupling has 5 valves that open or close due to the spring force:

- two suction valves,
- two pressure valves and
- the pressure limiting valve.

The coupling opening control solenoid valve N373 is one of the electrical components.

Oil system

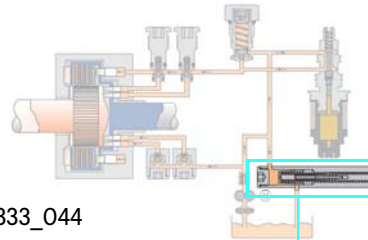
You will find all hydraulic components in the following picture. The diagram has been simplified to make it easier to understand: Instead of two as shown below, three actuating roller pairs for the listing pistons are operated by the lifting plate. The two rollers in a pair are arranged at an angle of 120°.



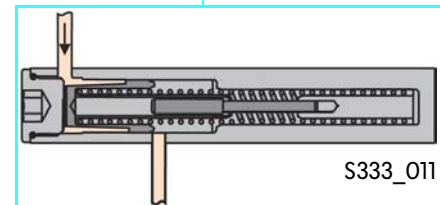
Accumulator

The accumulator sets the supply pressure using the spring force and keeps the pressure constant.
The supply pressure set by the accumulator is 3.2bar in the Golf 2004 and 3.8bar in the Transporter 2004.

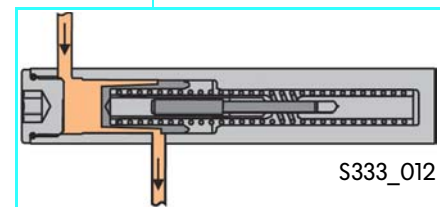
S333_044



System pressure-free: The accumulator spring is relaxed no oil flows through.



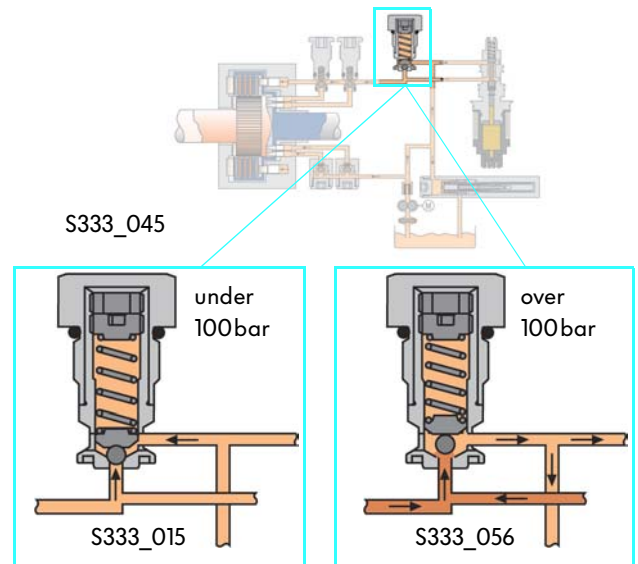
System with supply pressure: If the supply pressure is too high, it will be reduced by the accumulator towards the oil reservoir. If the pressure is too low, the spring will reduce or stop the flow.



Haldex Coupling

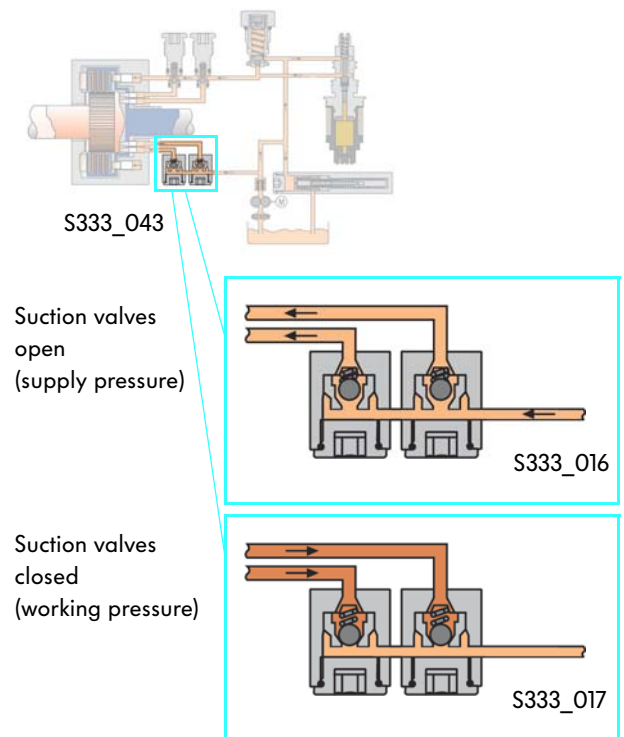
Pressure limiting valve

The pressure limiting valve is used to protect the components and limits the working pressure to approx. 100bar. It works using a spring set to a specific force. If the pressure in the system rises to 100bar, the pressure limiting valve will open and allow the oil to flow via the accumulator into oil reservoir. The overpressure is reduced in this way.

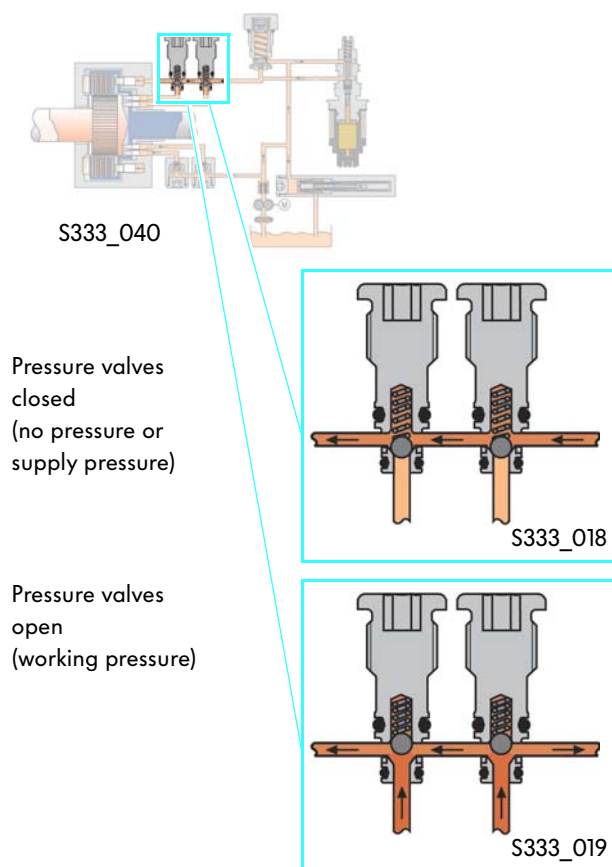


Suction valves

The suction valves are on the supply pressure side of the Haldex coupling and the lifting piston. They are spring-loaded and open when the supply pressure is applied in the direction of the lifting piston. If a working pressure is built up by the lifting piston, the suction valves will close so that the pressure on the lifting piston or working piston is maintained.



Pressure valves



The pressure valves are located between the lifting piston, the working piston and the control circuit with the pressure limiting valve and the coupling opening control valve N373. They are spring-loaded and open when the supply pressure is exceeded.

They then transfer the pressure from the lifting piston to the working piston. At the same time, they open the control circuit with the coupling opening control valve N373.

They prevent pressure reduction towards the lifting piston by closing when the working piston reaches a low point on the lifting plate.



Haldex Coupling

System overview

Sensors



G28 Engine speed sender

G79 Accelerator pedal position sender

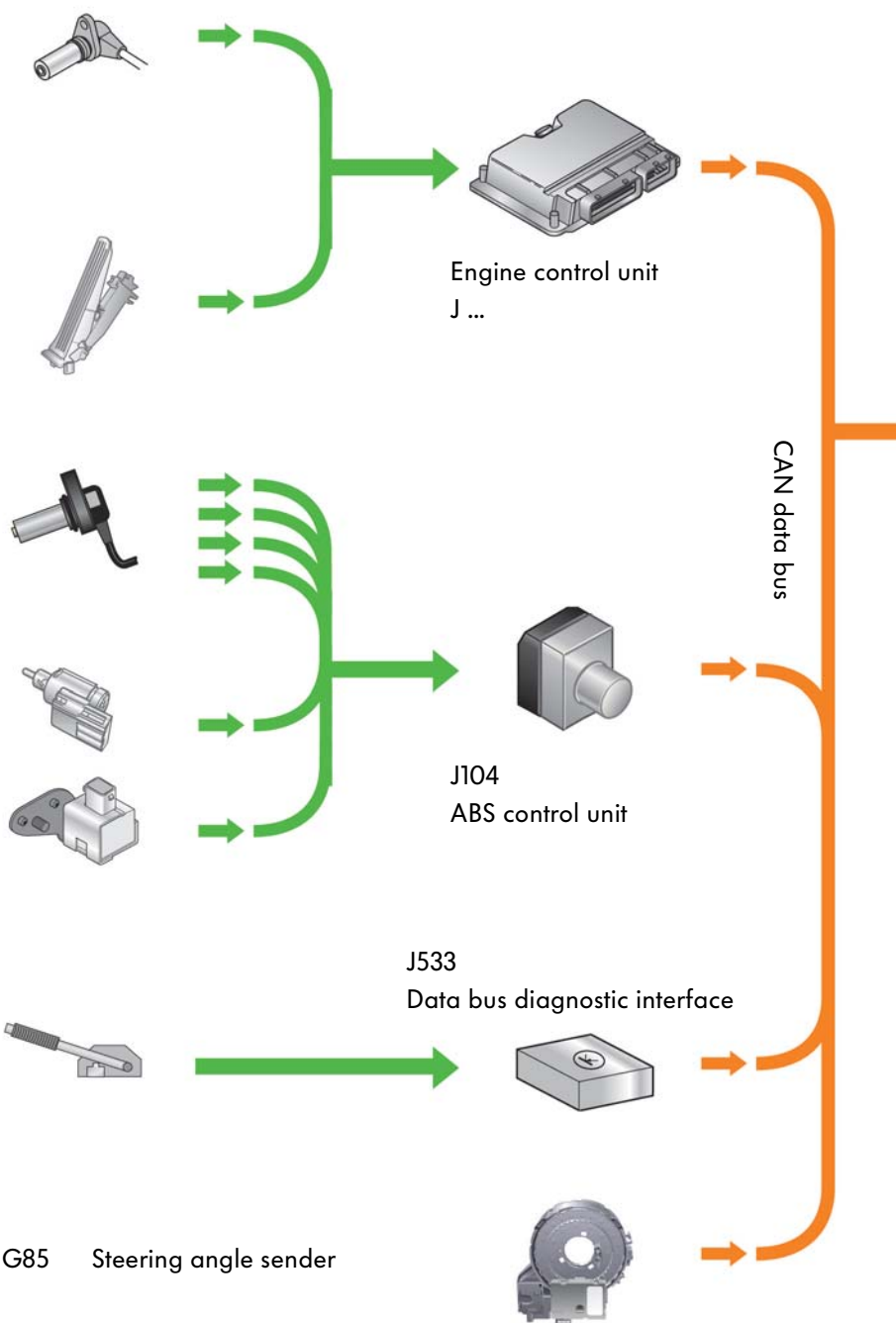
G44 - G47 Speed sensor

F Brake light switch

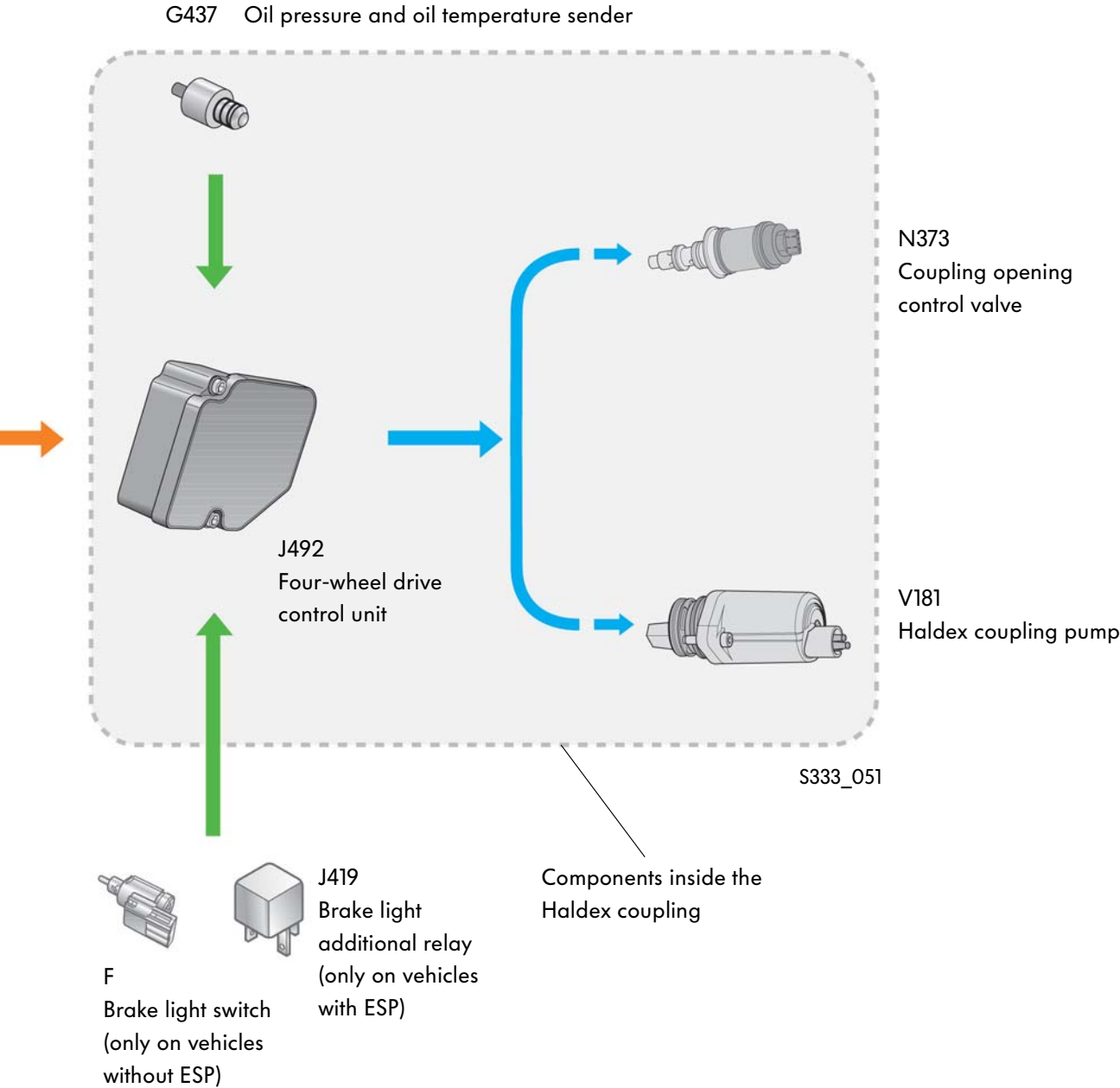
G165 Acceleration sender

F9 Handbrake warning switch

G85 Steering angle sender



Control elements



Haldex Coupling

Electrical and electronic components

The electrical and electronic components include the oil pressure and oil temperature sender G437 plus the Haldex coupling pump V181 and coupling opening control valve N373 as control elements.

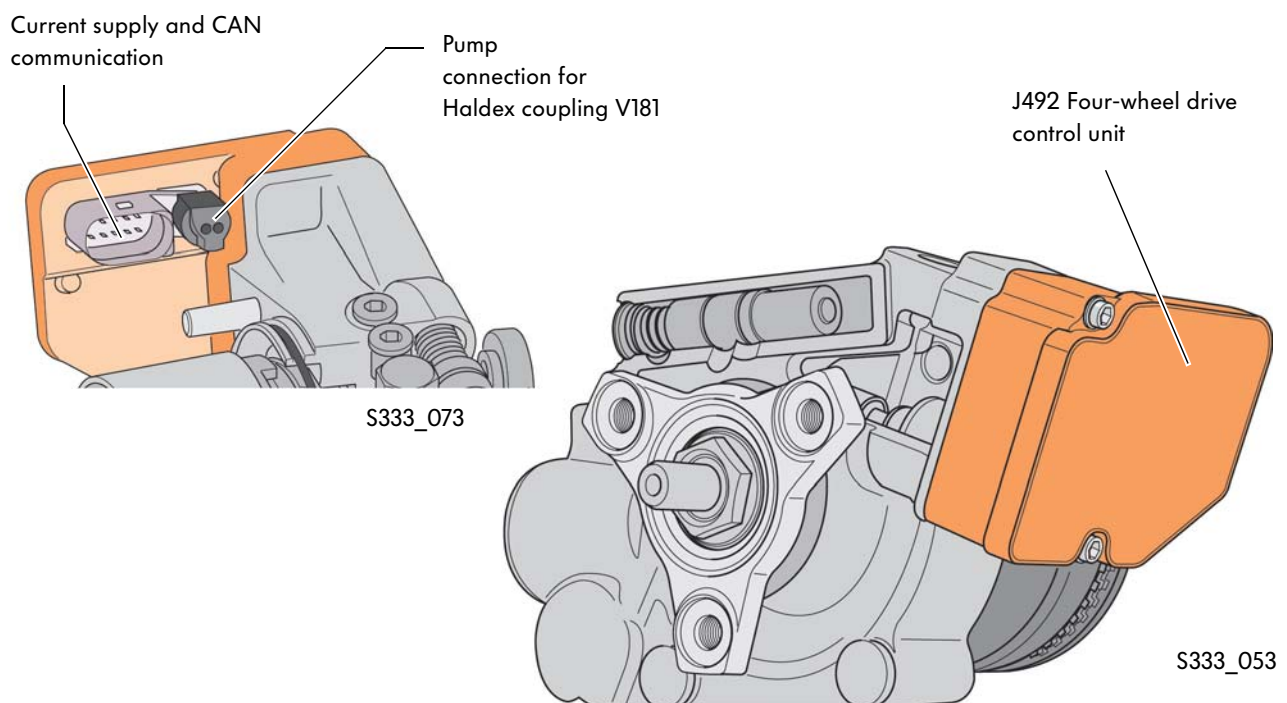
Furthermore the Haldex coupling has its own control unit, the four-wheel drive control unit J492.

Four-wheel drive control unit J492

In the Haldex II, the four-wheel drive control unit J492 is incorporated in the drive CAN data bus. This allows it to regulate the system precisely with a few individual sensors (oil pressure and oil temperature sender).

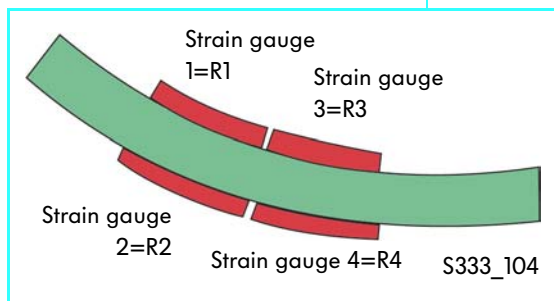
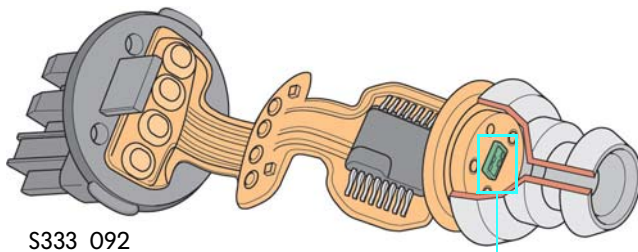
The control unit uses the data from the oil pressure and oil temperature sender G437 and the data on the driving situation from the CAN data bus to check whether the pressure corresponds with the required position of the clutch plate set. It can then tune the opening state and the Haldex coupling transmission optimally to the situation.

If an ESP or ABS intervention occurs, the four-wheel drive control unit J492 will open the Haldex coupling.



Sensors in the Haldex coupling

Oil pressure and oil temperature sender G437



The oil pressure and oil temperature senders are in the same component.

The temperature is measured with an NTC. The pressure is measured with a measuring element that is equipped with strain gauges using a full-bridge circuit. The ohmic resistance (R) varies.

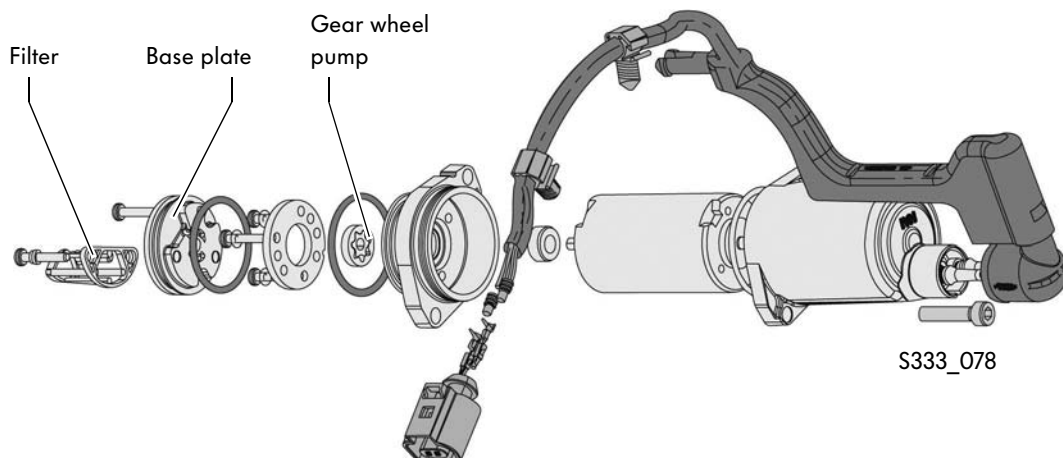
Up to a pressure of 100bar, the coupling opening control valve N373 regulates the pressure depending on the driving situation.

The oil pressure and oil temperature are needed to switch the coupling easily and according to the situation.

Control elements in the Haldex coupling

Haldex coupling pump V181

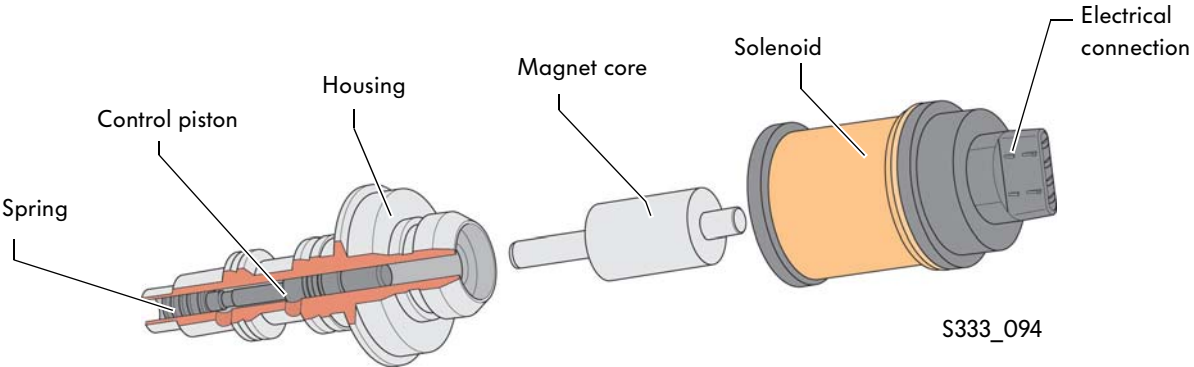
The Haldex coupling pump V181 generates the supply pressure and thus causes the clutch set to contact so that the closing time of the coupling is very short. It always runs when the vehicle is being used and thus keeps the system filled.



Haldex Coupling

Coupling opening control valve N373

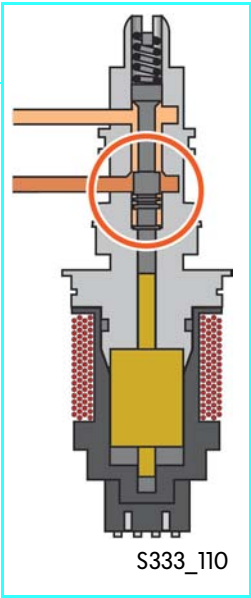
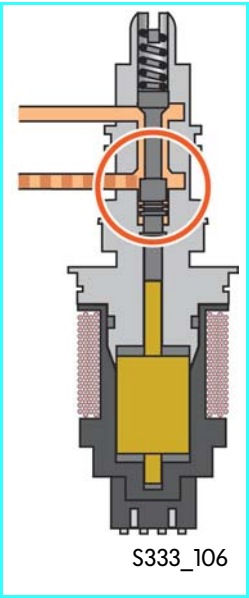
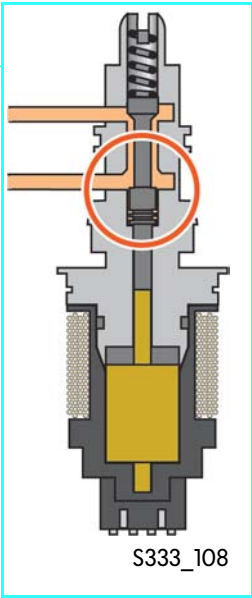
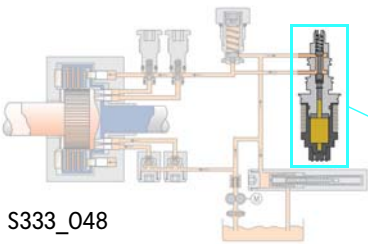
The coupling opening control valve N373 regulates the working pressure depending on the engine load.



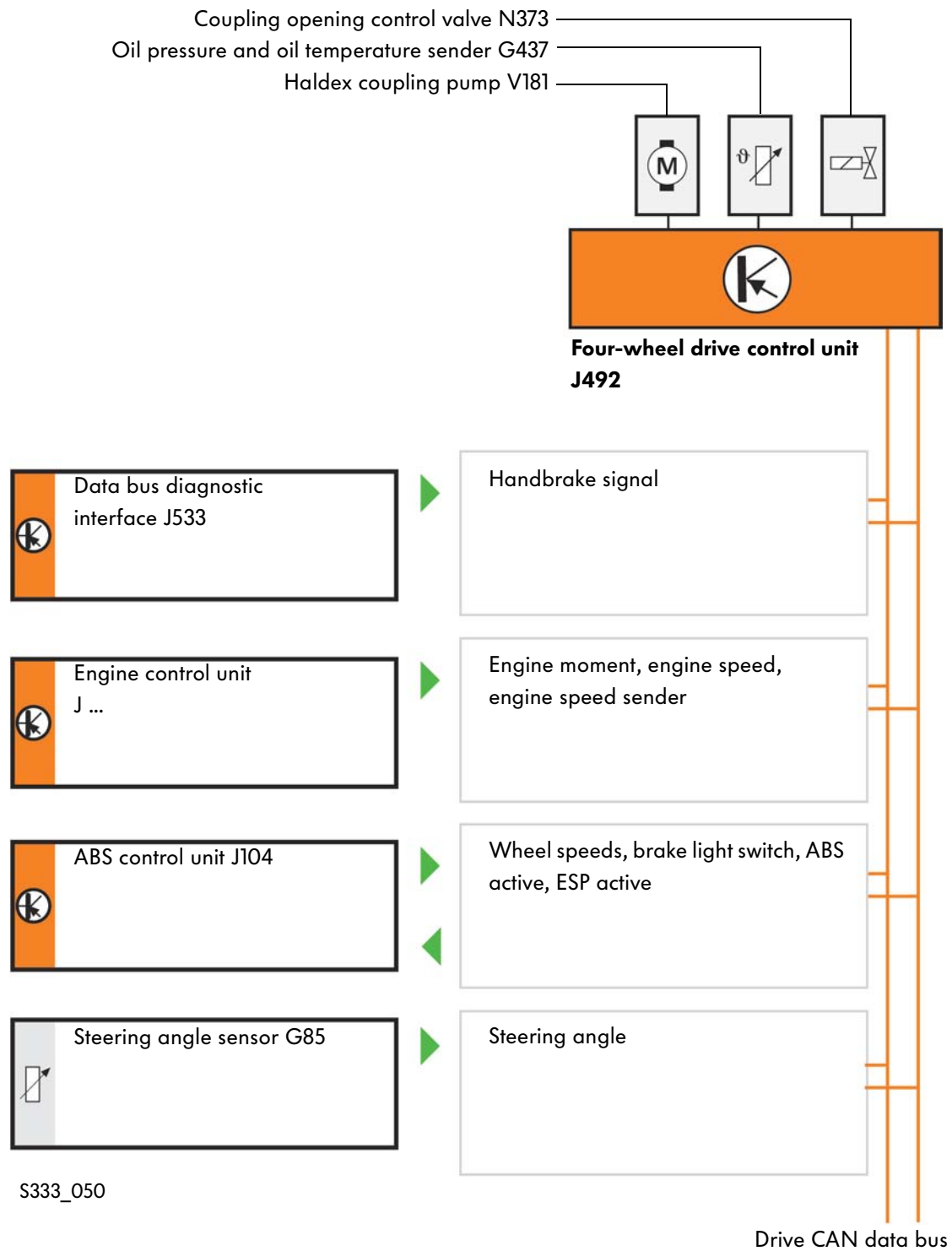
Valve not triggered, open

Valve partly powered, partial load, low clamping load

Valve fully powered, closed, the pressure generated by the lifting piston is transferred completely.



CAN networking

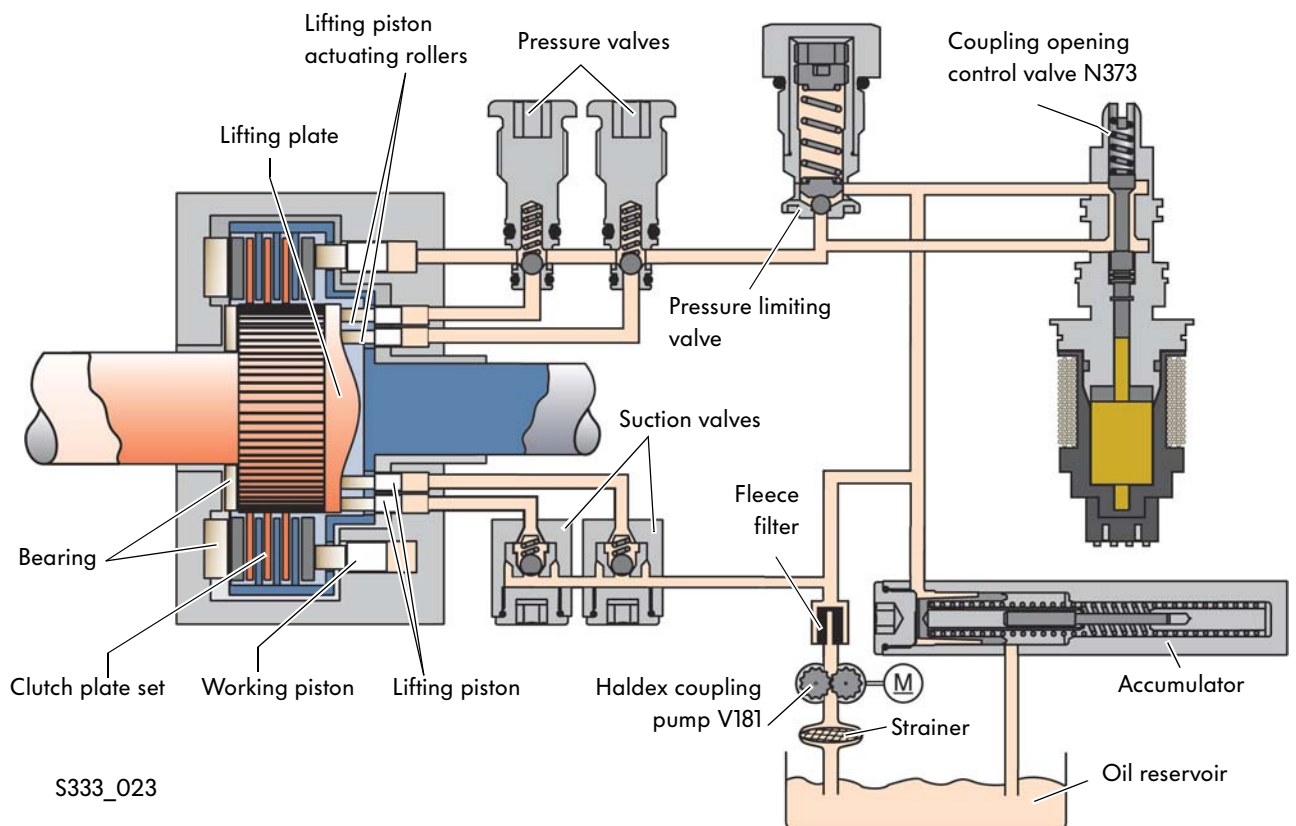


Haldex Coupling

Control

In the following section, you will find the states within the hydraulic system in different situations. Firstly the two extreme states "Ignition on" and "Engine full load" are described.

The system when the ignition is on



When the ignition is switched on and the engine does not issue a speed signal, the Haldex coupling system is pressure free.

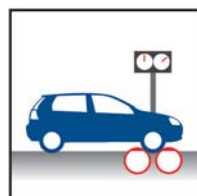
All valve springs are relieved. Pressure is built up again and another oil flow started.

Special situations:

There is a large speed difference between the front and rear axle, but no engine speed signal. Torque is not transferred at the rear axle.

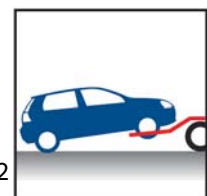
Examples:

Roller dynamometer



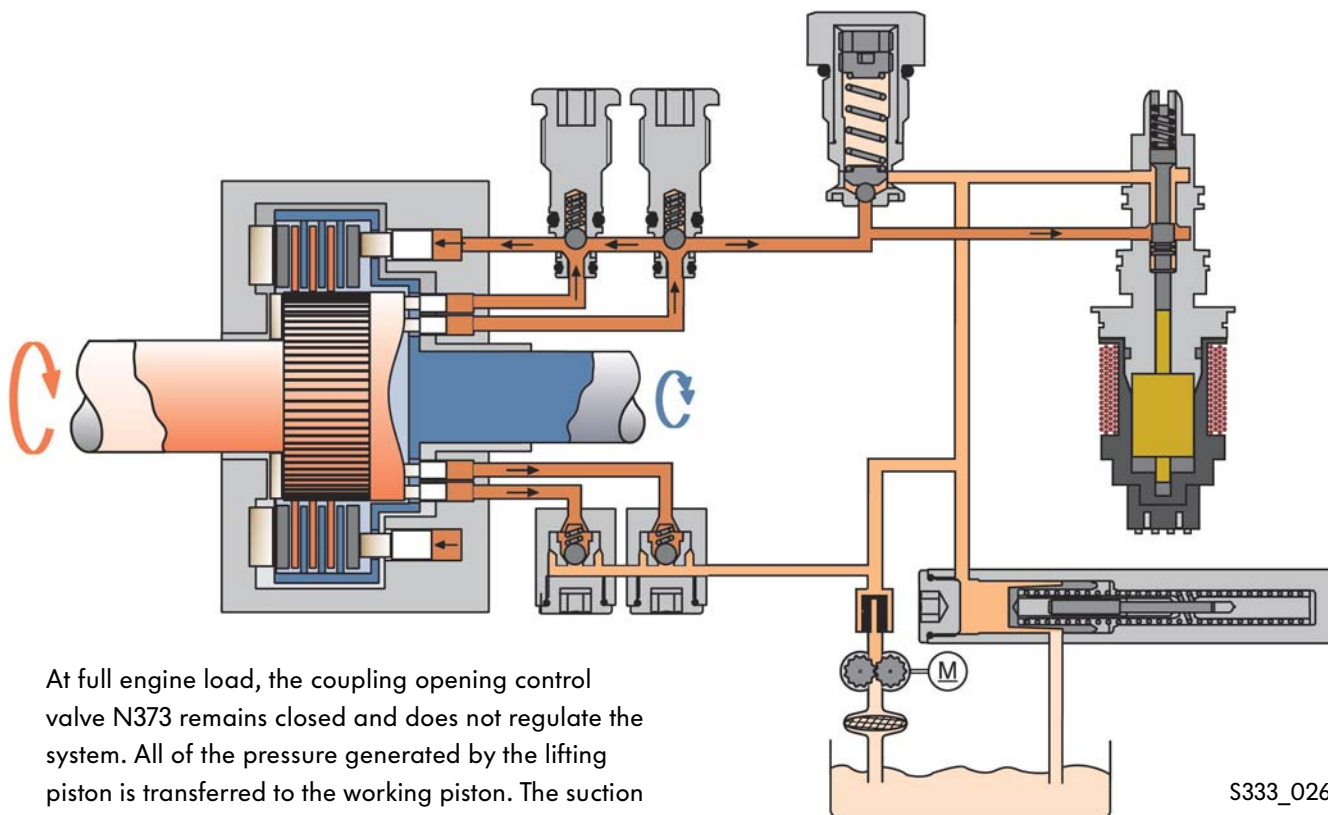
S333_062

Towing



S333_063

The system with full engine load



At full engine load, the coupling opening control valve N373 remains closed and does not regulate the system. All of the pressure generated by the lifting piston is transferred to the working piston. The suction valves close the oil flow in the direction of the pump and accumulator. The pressure valves ensure by opening upon each pumping procedure that the pressure reaches the working piston and close again so that the pressure is not reduced in the direction of the lifting pistons when they reach a "low point" on the lifting plate.

There is a positive connection between the input and output shaft.

The maximum pressure in the system is defined by the pressure limiting valve: It opens at a pressure of 100 bar so that pressure is relieved through the channel via the accumulator into the oil reservoir.

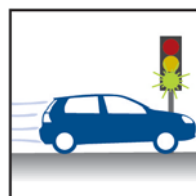
Driving situations:

Driving situations are sporty starts (accelerating) or driving on ice with the front wheels.

There is a large difference in speed between the front and rear axle. A high torque is needed constantly on the rear axle.

Examples:

Accelerating



S333_060

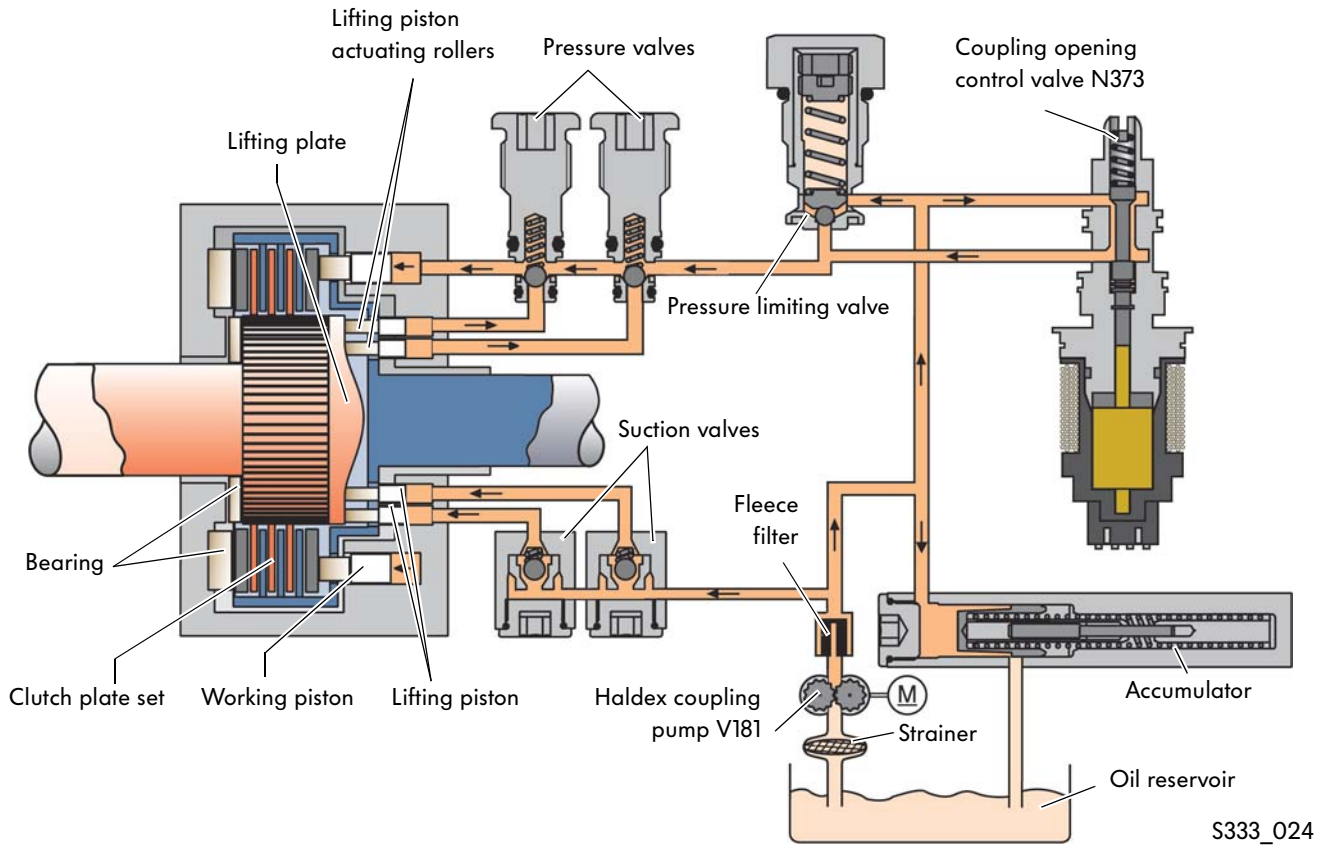
Slippery surface



S333_058

Haldex Coupling

The system when engine is idling

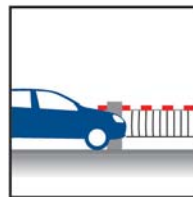


Driving situations:

There is no speed difference between the front and rear axle. Torque is not required at the rear axle.

Examples:

Standing with engine running



S333_061

Build-up of supply pressure

- The ignition is switched on and the engine speed is over 400 rpm.
- The four-wheel drive control unit J492 recognises these states and sends a signal to the Haldex coupling pump V181. This starts to pump and builds up the supply pressure (3.2bar for the Golf 2004 and 3.8bar for the Transporter 2004).
- At the same time, there are no speed differences between the front and rear axle so that no pump effect is triggered on the lifting piston.
- The suction valves are opened by the springs and transfer the supply pressure to the lifting piston.
- The supply pressure also reaches the working pistons via the open coupling opening control valve N373 via the pressure valves.
- The clutch plates are applied by the supply pressure.
- The whole system is filled and ready within a short amount of time.



Explanations:

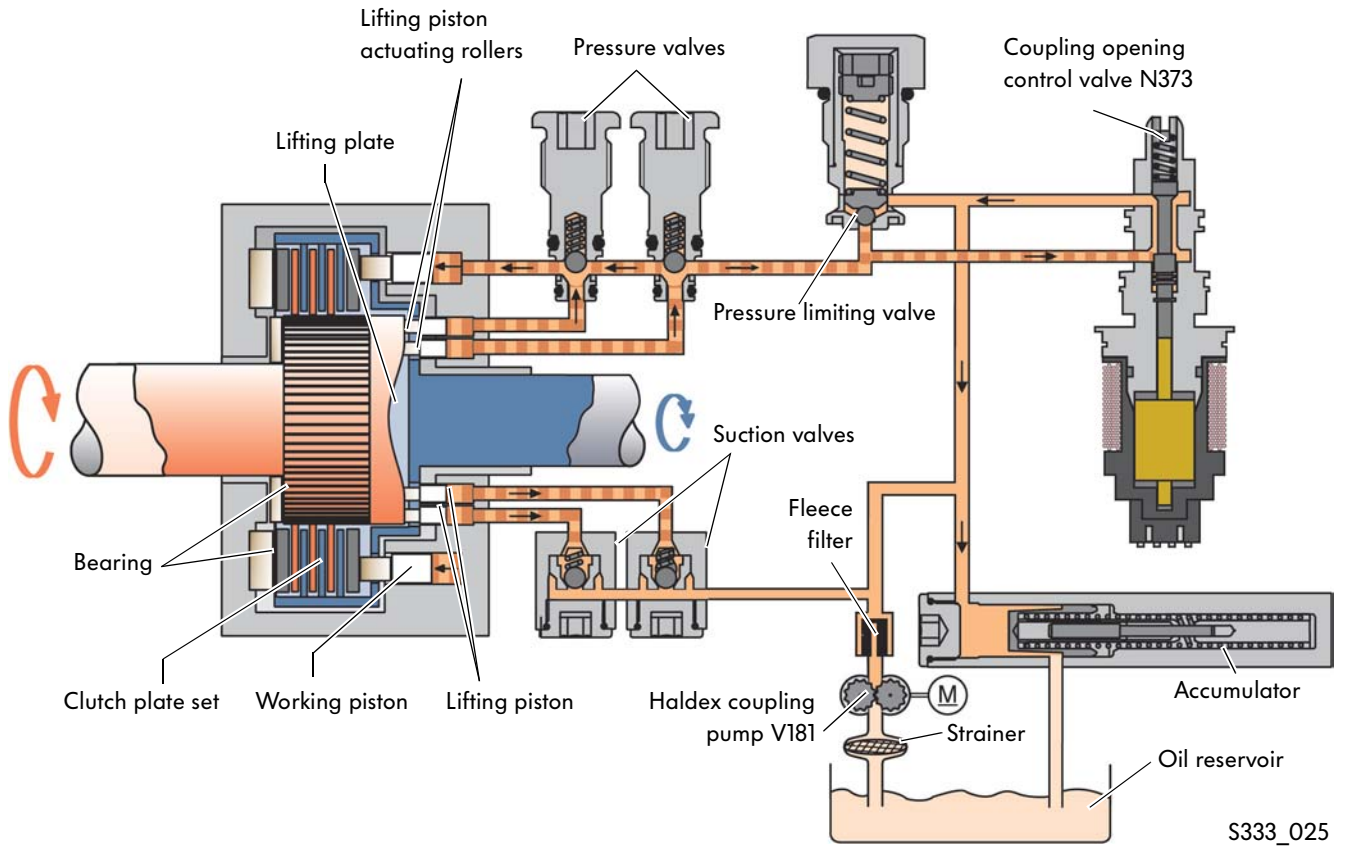
The supply pressure removes the play between the inner and outer plates, which is otherwise created by the spring force.

This guarantees fast response of the system.

The accumulator regulates the supply pressure to 3.2bar for the Golf or 3.8bar for the Transporter and evens out pressure fluctuations.

Haldex Coupling

The system with partial engine load

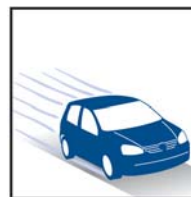


Driving situations:

The speed difference between the front and rear axle is low. A low torque is required at the rear axle.

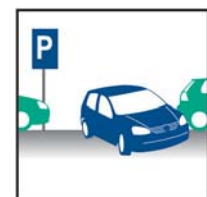
Examples:

Fast driving



S333_057

Parking



S333_059

Build-up of working pressure

- Supply pressure is set in the hydraulic system.
- Due to the driving situations, there are speed differences between the input and output shaft.
- The lifting pistons run over the lifting plate and pressure is built up.
- The suction valves close.
- The pressure valves open and forward the pressure to the lifting pistons.
- The clutch plate set is pressed together by the working piston actuating rollers and the thrust washer.
- The coupling opening control valve N373 holds the pressure by closing depending on the driving situation or reduces it by opening. It receives the signal for opening or closing from the four-wheel drive control unit J492.
- The clutch plate set is closed completely or partly depending on the driving situation and the rear axle is driven as required.



Explanations:

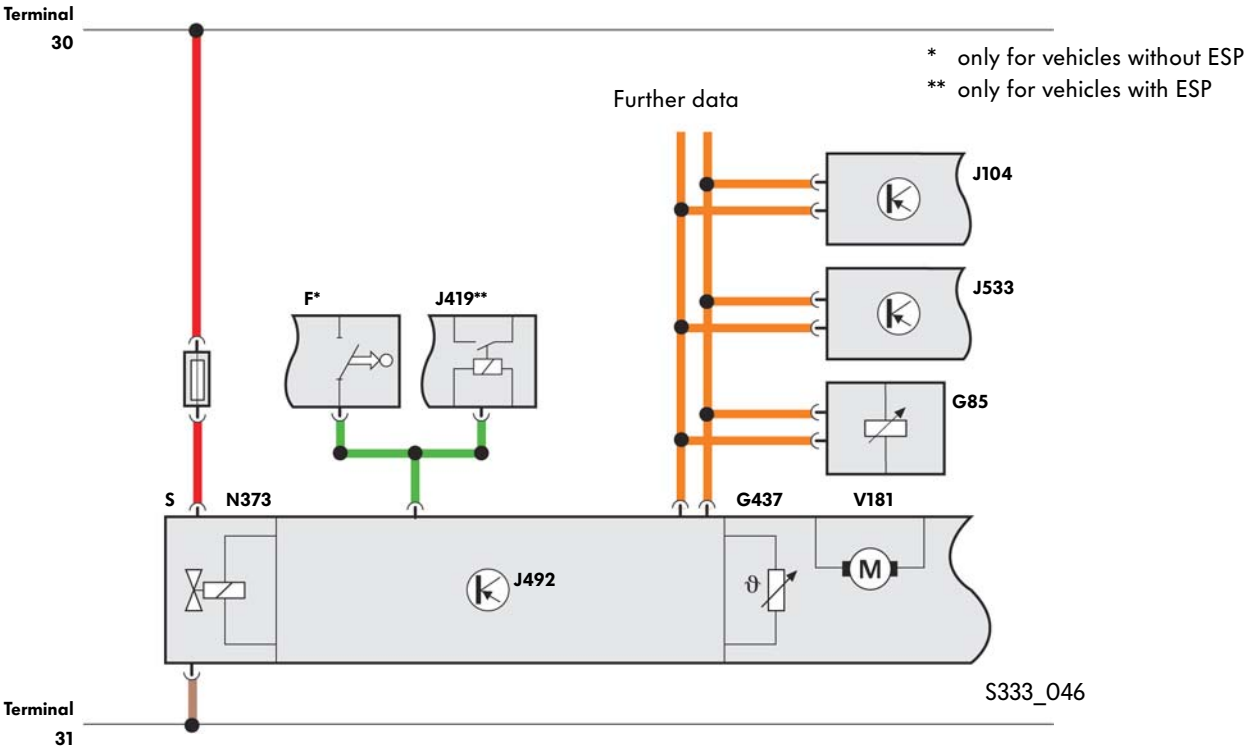
In certain driving situations, for example, on fast curves, a greater pressure can be generated, but for reasons of comfort, the maximum torque does not have to be transferred.

In this case, it is advantageous to only build up the part of the pressure needed. The coupling opening control valve N373 is opened further in this case.

The four-wheel drive control unit calculates how much torque has to be transferred to optimise the driving situation via the Haldex coupling.

Haldex Coupling

Functional Diagram



- | | | | |
|------|---|------|--------------------------------|
| F | Brake light switch | N373 | Coupling opening control valve |
| G85 | Steering angle sender | S | Fuse |
| G437 | Oil pressure and oil temperature sender | V181 | Haldex coupling pump |
| J104 | ABS control unit | | |
| J419 | Brake light additional relay | | |
| J492 | Four-wheel drive control unit | | |
| J533 | Data bus diagnostic interface | | |

- Colour code/legend**
- Input signal
 - Output signal
 - Positive
 - Earth
 - CAN data bus

Golf 2004 rear axle

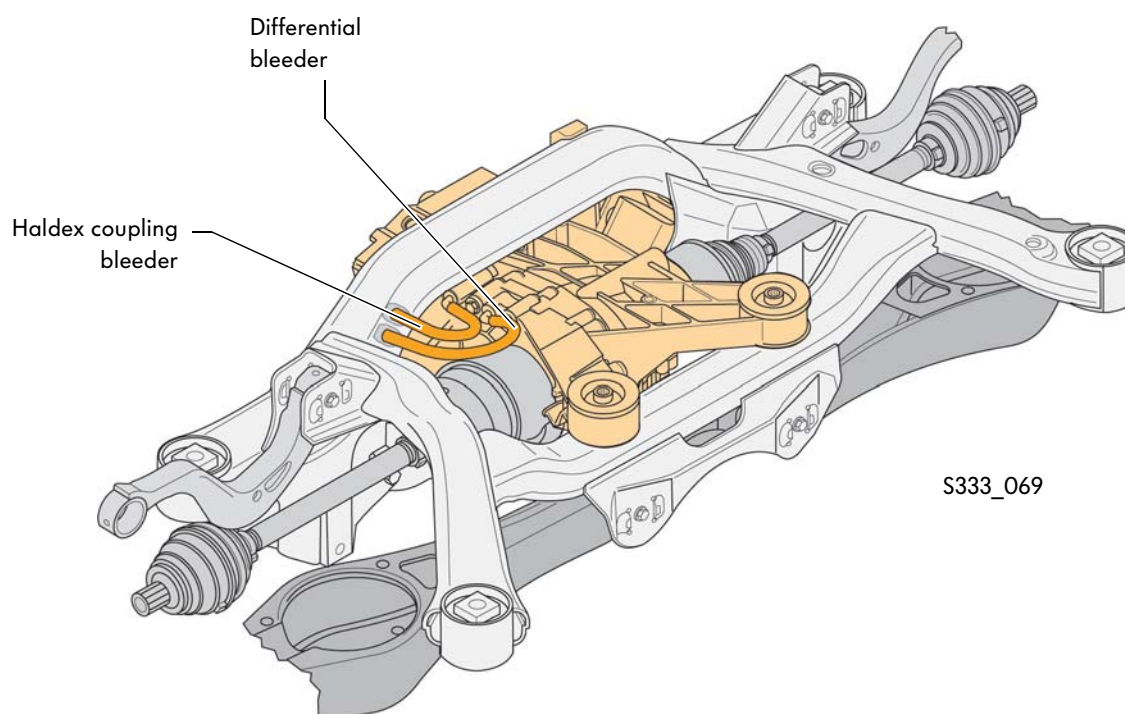


Please refer to self-study programme 321 “The Golf 2004 – Chassis” for information on the rear axle of the Golf 2004.

Bleeding the gearbox

It is particularly important to bleed the gearbox components for rear-wheel drive with the Haldex coupling, the bevel gear system, the differential and the differential lock. These components are very sensitive to water and the bleed hoses need to be connected carefully.

When the rear axle differential on the Golf 2004 is bled, it is now bled into the rear-axle casing.



Transporter 2004 rear axle

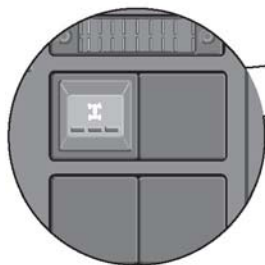
The rear axle of the Transporter 2004 does not have any major changes compared with the previous model.

Differential Lock

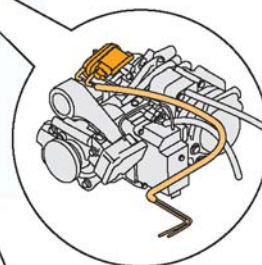
Differential lock in Transporter 2004

In the Transporter 2004 with 4MOTION, an optional mechanical differential lock can be used. The differential lock is made up of the lock at the rear, the differential lock control unit J187, the valve block behind the front left-hand wheel housing and the activating switch in the dash panel insert. In addition, the state of the differential lock in the dash panel insert is indicated by a warning lamp.

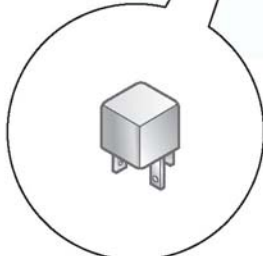
Rear differential lock switch E121, at front of dashboard



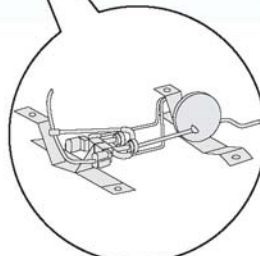
Differential lock with reed contact switches 1-3 for differential lock F360-362



Control unit for differential lock J187, on the cockpit relay carrier



Valve block with valves 1 and 2 for differential lock N125 and N126



S333_095

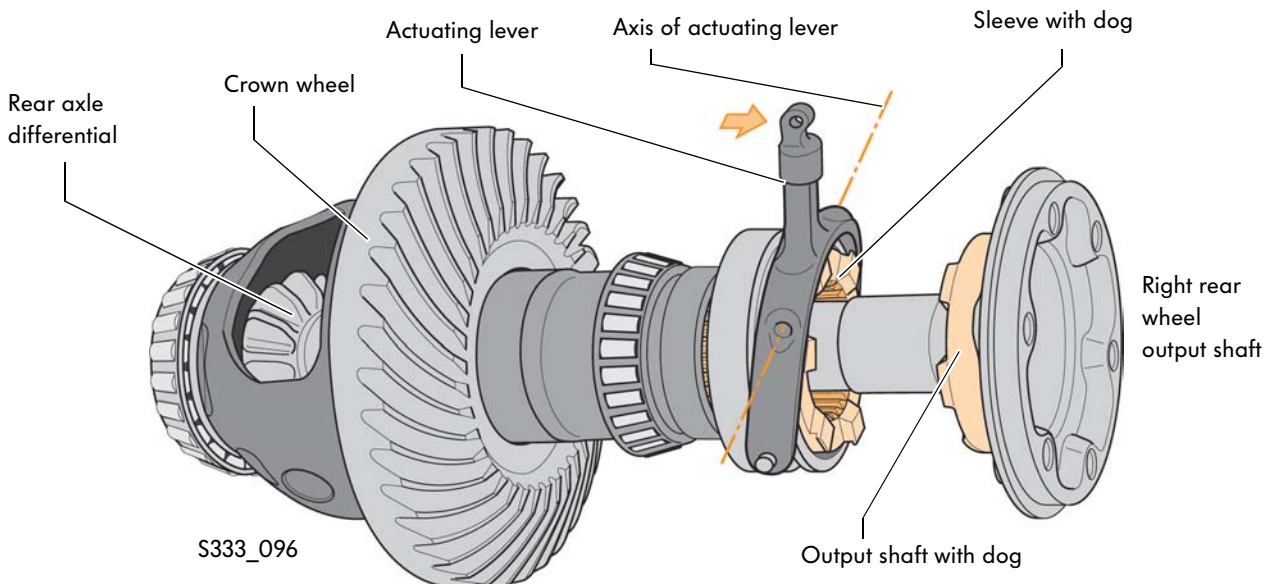
If the driver presses the differential lock button, the signal will be forwarded to the differential lock control unit J187. The differential lock control unit J187 receives the signal whether the conditions for switching on the differential lock are met from the differential lock control unit J104. If this is the case, it will operate differential lock valves 1 and 2 (N125 and N126) and the lock will be switched on.

The reed contact switches 1-3 for differential lock (F360-362) signal the state of the differential lock to the ABS control unit J104.

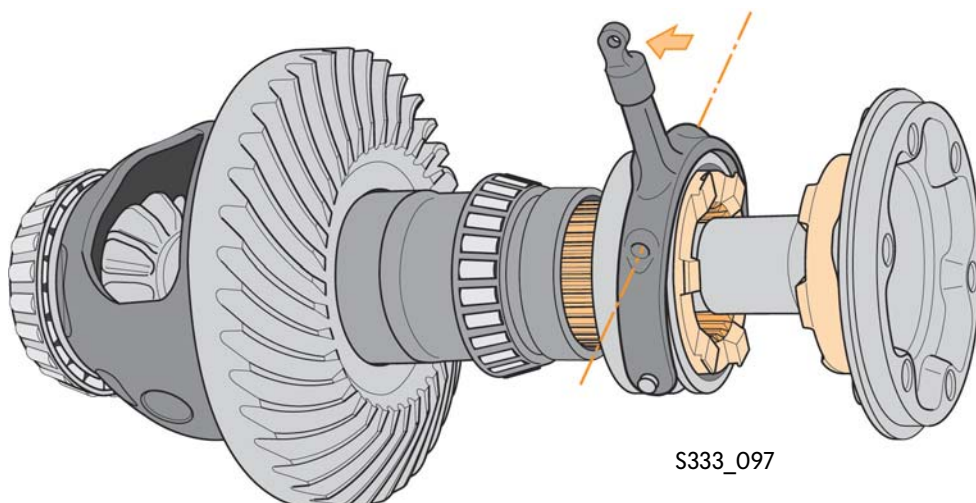
Function

Differential lock valves 1 and 2 (N125 and N126) ensure that there is a vacuum in one of the chambers of the pressure cell on the reed contact switches 1-3 for differential lock (F360-F362). This moves the actuating lever so that the dog clutch is closed. If the dog clutch engages, a positive connection between the two wheel output shaft will be formed and the differential is thus locked.

Position of the lever and the sleeve when lock is open



Movement of lever and sleeve upon closing

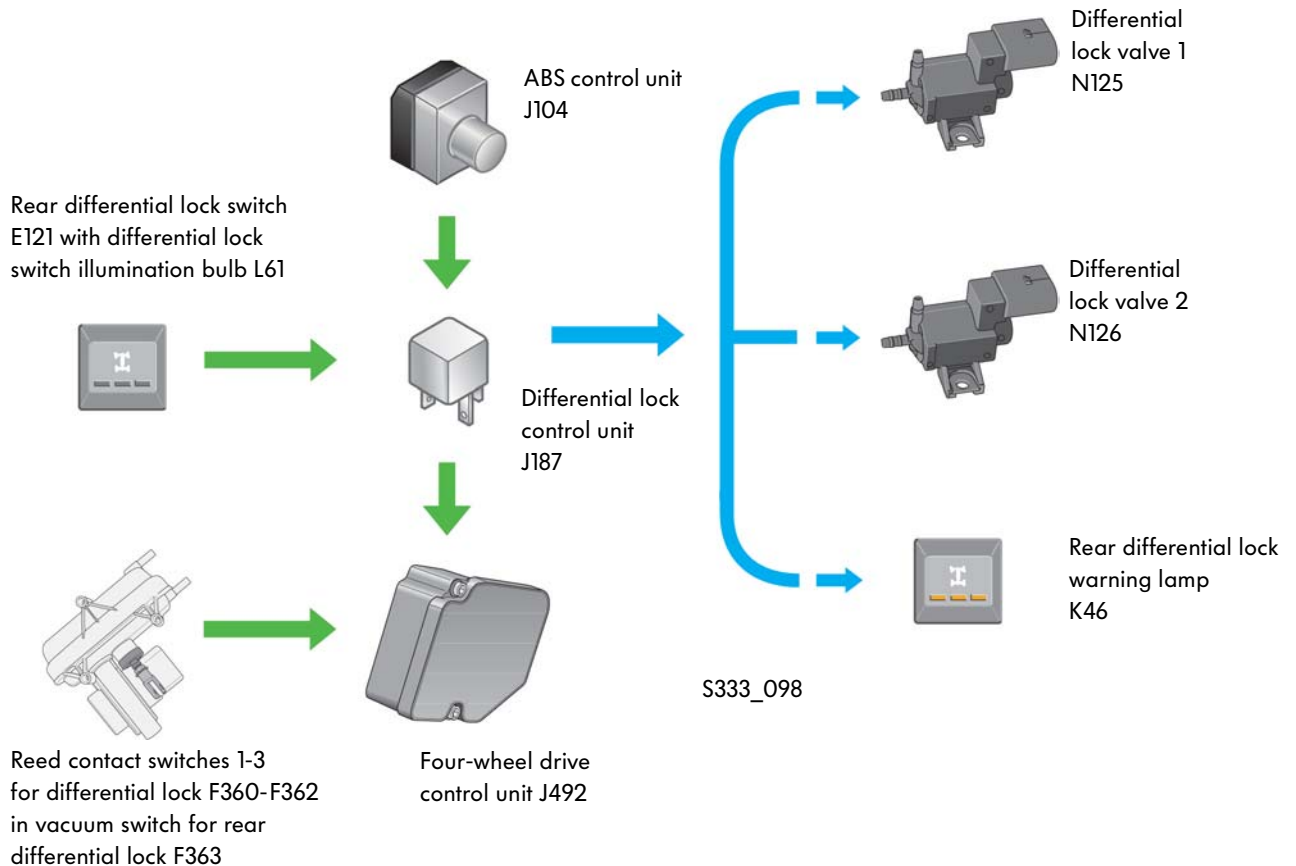


Differential Lock

System overview

Control elements

Sensors



Switching on conditions

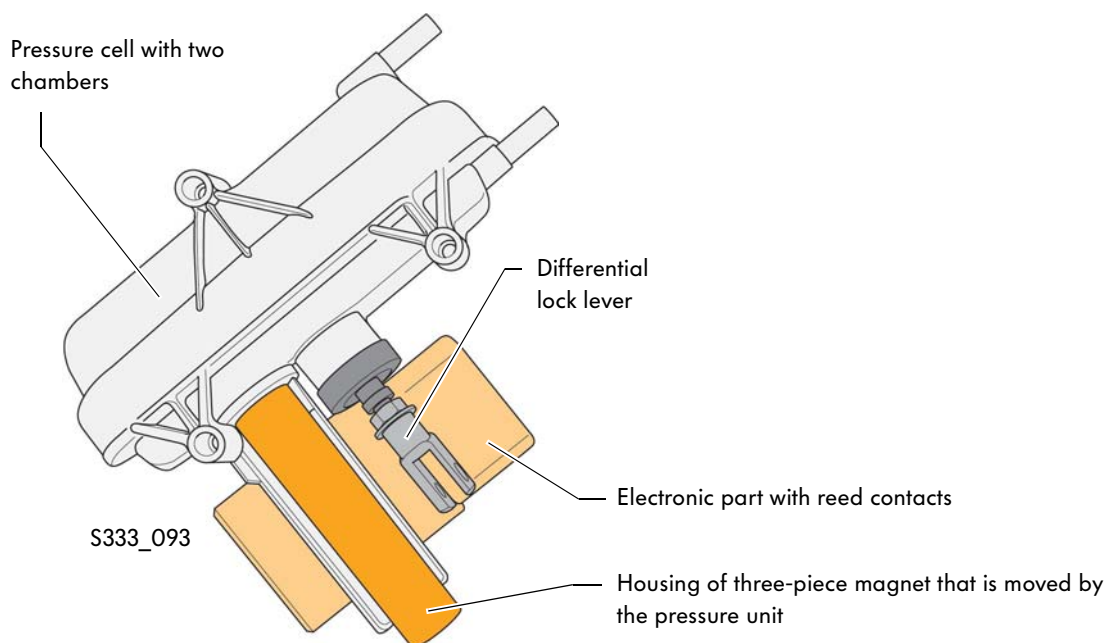
The differential lock switch E121 and the ABS control unit J104 regulate the differential lock control unit J187.

The differential lock can only be engaged when the vehicle speed is below 45km/h and the difference between the speed of the rear wheels is below 7.2km/h.

The ESP is switched off before the lock engages.

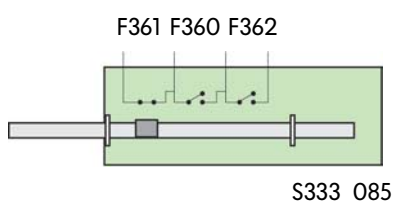
Reed contact switches 1-3 for differential lock F360-F362

The reed contact switches 1-3 for differential lock F360-F362 are located in the vacuum switch for rear differential lock F363. There is a permanent magnet on a connecting rod. The connecting rod runs parallel to the vacuum on the three reed contacts. The three switches are opened or closed depending on the state of the differential lock. The three possible positions signal different voltages to the control unit. This allows, for example, the system to distinguish whether there is just an “engage lock” request or whether it is already closed.

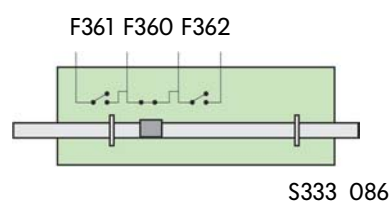


The voltage in the component changes according to the switch position and the four-wheel drive control unit J492 receives a signal about the state of the differential lock. Three different states are recognised.

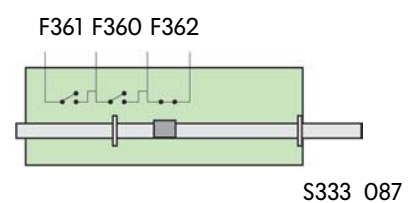
Differential lock not engaged (shaft open)



Request from button

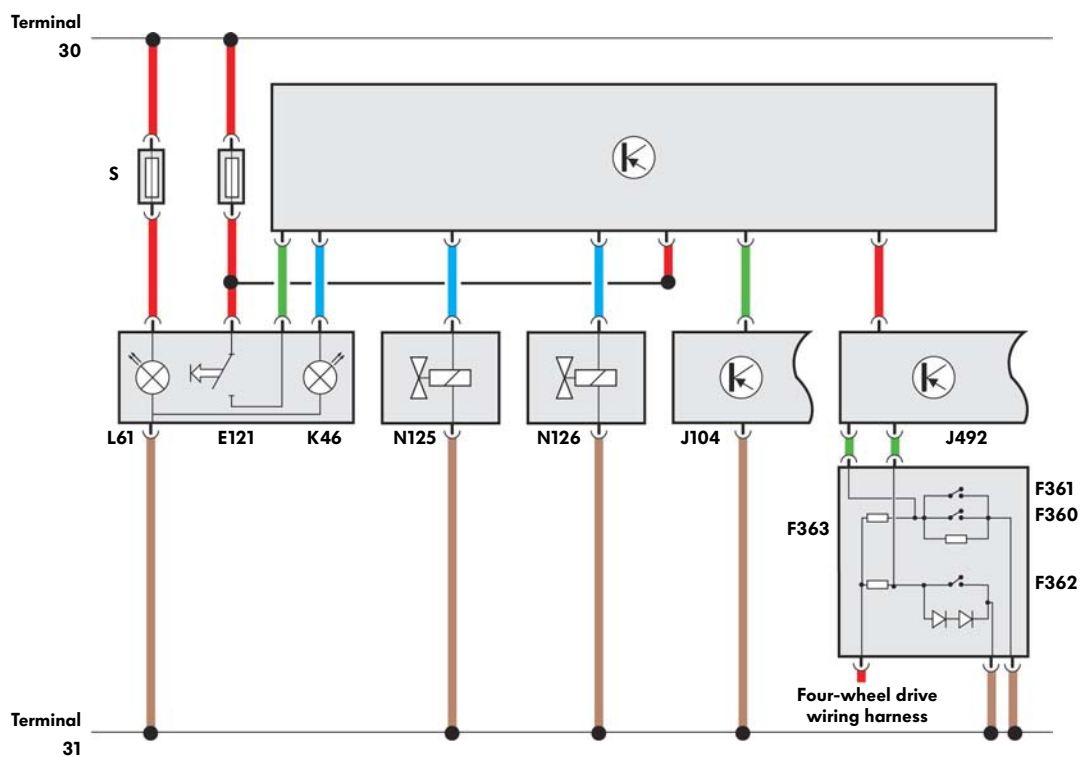


Differential locked



Differential Lock

Functional diagram

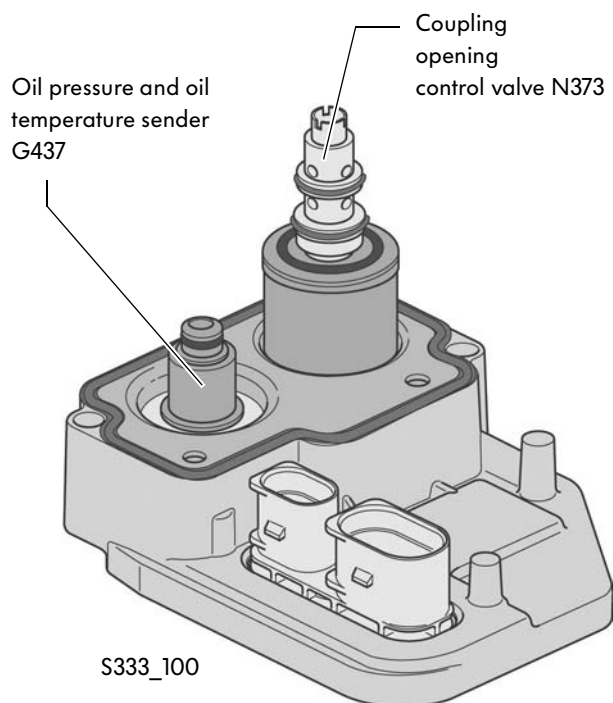


S333_099

E121	Rear differential lock switch	K46	Rear differential lock warning lamp
F360	Reed contact switches 1 for differential lock	L61	Differential lock switch illumination bulb
F361	Reed contact switches 2 for differential lock	N125	Differential lock valve 1
F362	Reed contact switches 3 for differential lock	N126	Differential lock valve 2
F363	Vacuum switch for rear differential lock	S	Fuse
J104	ABS control unit		
J187	Differential lock control unit		
J492	Four-wheel drive control unit		

Colour code/legend	
	Input signal
	Output signal
	Positive
	Earth

Four-wheel drive control unit J492



The four-wheel drive control unit J492 is always replaced together with the oil pressure and oil temperature sender G437 and the coupling opening control valve N373.

It has the address word 22 for self-diagnosis.



- The Haldex coupling can be replaced separately. There is no need for complicated adjustments after replacement as the drive pinion in the rear-axle differential is no longer replaced, instead it remains in the housing.
- The paper filter has been replaced with a maintenance-free fleece filter.
- The oil volume has been increased. This has extended the oil change intervals.

Test Yourself

1. What improvements does the second-generation Haldex coupling have compared with the previous model?

- ☐ a) Fitting and removal of the whole Haldex coupling has been simplified.
- ☐ b) The coupling opening control valve N373 has been optimised.
- ☐ c) The oil volume has been increased so that the service intervals can be extended.
- ☐ d) The freewheel on the rear-axle drive has been made smaller.

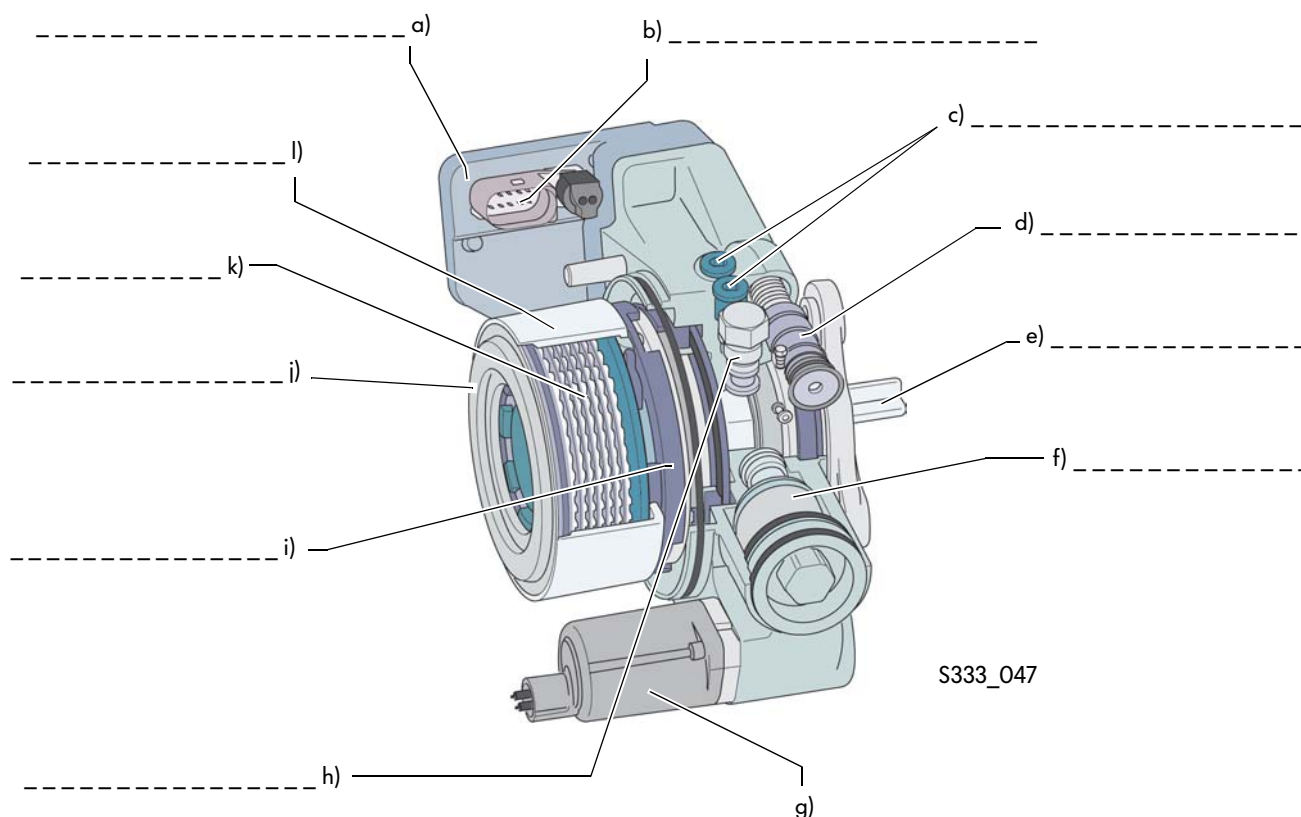
2. What happens in the case of ESP intervention?

- ☐ a) The Haldex coupling is opened.
- ☐ b) The clamping load in the Haldex coupling is maximised.
- ☐ c) EDL is switched off.
- ☐ d) The rear differential lock warning lamp K46 begins to illuminate.

3. In which driving situations can a higher clamping load occur in the Haldex coupling?

- ☐ a) When the vehicle is towed and on the brake test stand. The speed difference between the front axle and the rear axle is high so that a high torque has to be transferred.
- ☐ b) When driving on slippery surfaces. The speed difference between the axles varies between high and low as does the torque required on the rear axle.
- ☐ c) When parking.

4. Name the components in the following diagram.



5. What is the purpose of the coupling opening control valve N373?

- ☐ a) It ensures that the working pressure does not rise above 100bar.
- ☐ b) It controls the working pressure using the engine load when the clamping load of the plates is greater than the torque required on the rear axle.
- ☐ c) It controls the supply pressure.

Test Yourself

6. What happens when the differential lock is engaged?

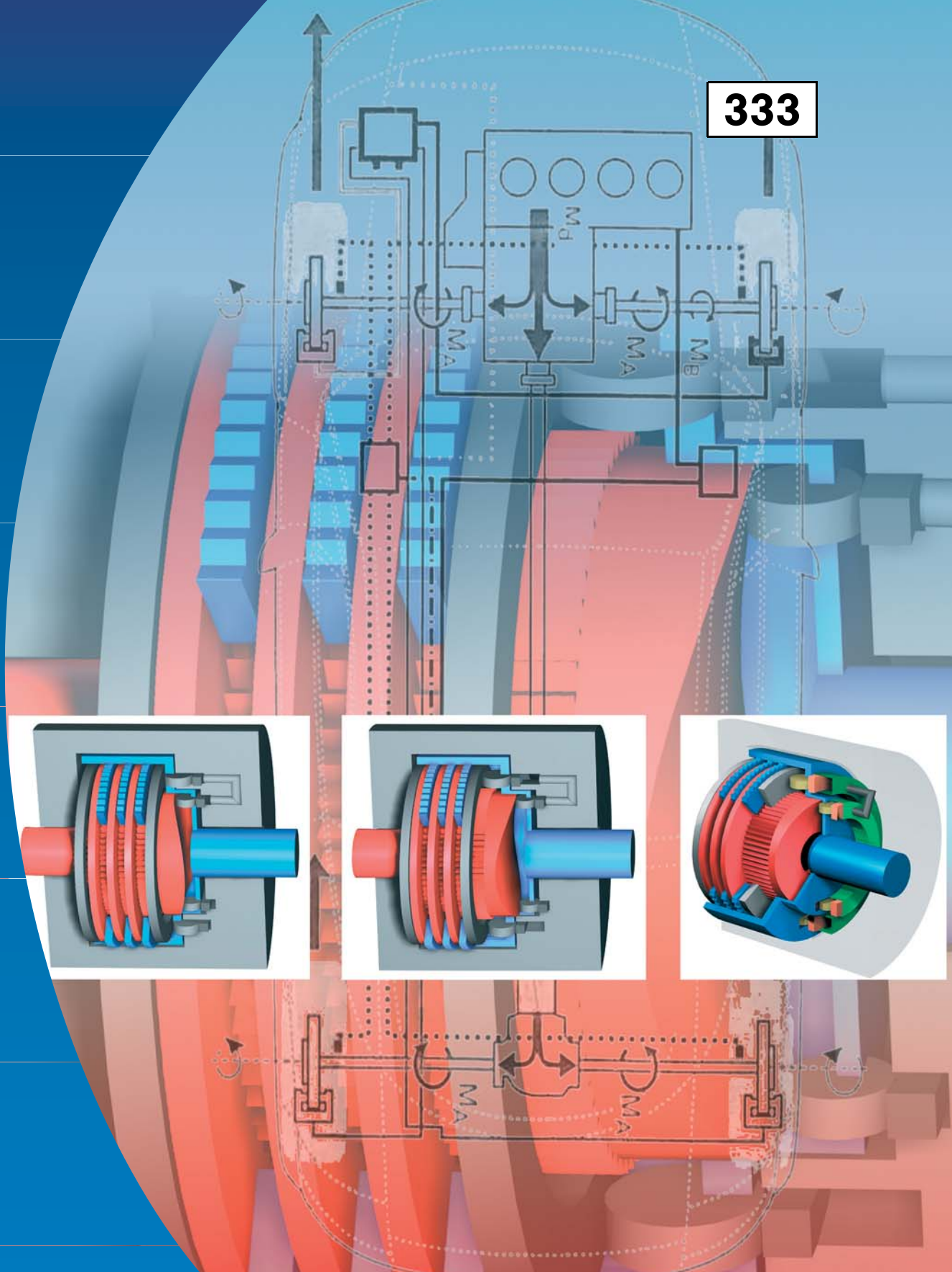
- ☐ a) ESP intervention can no longer occur.
- ☐ b) Speed differences between the two rear wheels are not compensated.
- ☐ c) Speed differences between the front and rear axle are not compensated.
- ☐ d) Different torques are transferred to both rear wheels as the wheels cover different distances.



Answers

1. a), b), c)
2. a)
3. b)
- 4.
- a) Four-wheel drive control unit J492
- b) Current supply and CAN communication
- c) Pressure valves
- d) Accumulator
- e) Drive shaft
- f) Oil filter
- g) Haldex coupling pump V181
- h) Pressure limiting valve
- i) Working piston
- j) Hub
- k) Wet plate clutch
- l) Plate housing
5. b)
6. a), b)





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