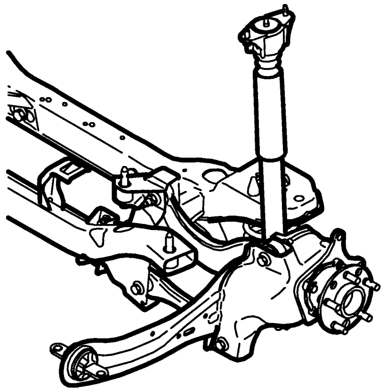
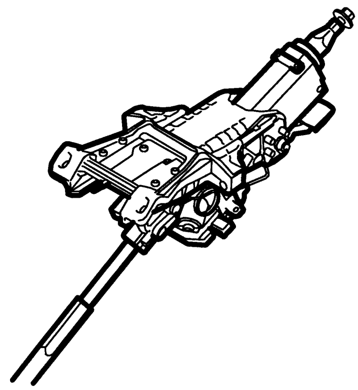
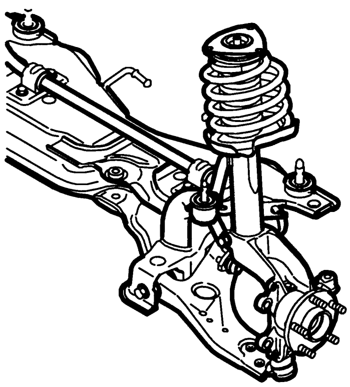
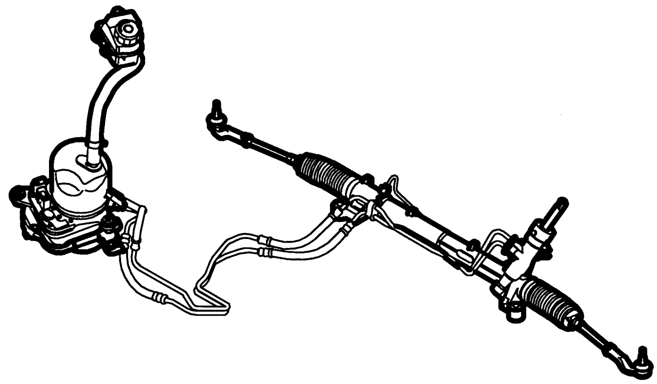





SUSPENSION AND STEERING

OVERVIEW

SUSPENSION

The S40/V50 has a wide track and a long wheelbase for its relative size and weight.

This gives the car stable and predictable driving characteristics. It also contributes to the powerful, sporting appearance of the car.

Both the front and rear suspension are independent. McPherson spring struts are used at the front while multilink suspension is used at the rear.

Depending on market demands there are two chassis setups available as standard -'comfort' and 'dynamic.'

Steering Gear

The steering gear is rack and pinion. There is only one version, regardless of the diameter of the rims.

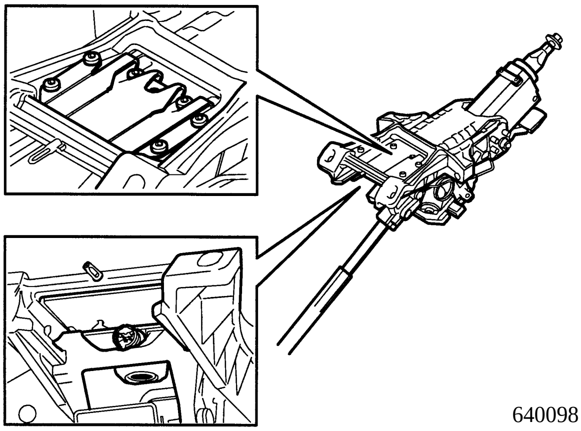
Power Steering

Power Steering is standard and of the Electro Hydraulic Power Assisted Steering (EHPAS) type.

The servo is controlled by a control module. The control module adapts the servo power principally depending on the speed of the car and how fast the steering wheel is being turned.

Steering wheel, steering column

The height of the steering wheel and steering column length can be adjusted.



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Both the upper and lower sections of the steering column have deformation zones.

On cars for the USA market, there is also a pyrotechnical collision protection system activated via the supplemental restraint system module (SRS).

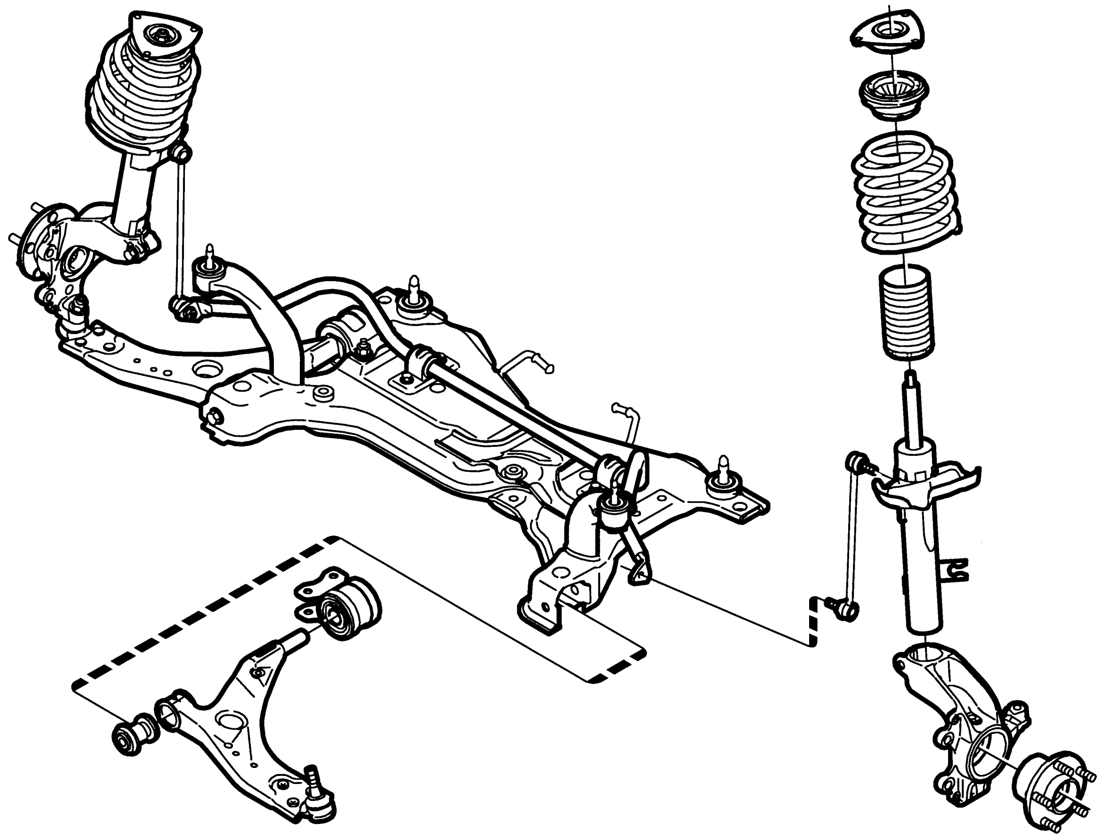
When the collision protection system is deployed, a pin is ejected. This makes the steering column soften longitudinally and easier to compress.

Steering wheel lock

The steering wheel lock is electrically controlled and is a part of the immobilizes system.

Dimensions, Curb Weight, Weight Distribution

- Length: S40= 4,468 mm (176 in.), V50= 4,514 mm (178 in.)
  The rear overhang on the V50 is slightly greater than on the S40.
- Width =1,770 mm (70 in.)
- Height =1,452 mm (at curb weight) (57 in.)
- Track, front =1,535 mm (60.4 in.)
- Track, rear =1,531 mm ((60.3 in.)
- Wheelbase = 2,640 mm (104 in.)
- Curb weight: S40 = approximately 1,400 kg, V50 = approximately 1,450 kg
  (Curb weight varies depending on engine and transmission. The weights given are approximate and are provided to give an indication of the weight of the car.)
- Weight distribution = 60% front and 40% rear
  (Weight distribution varies slightly depending on engine and transmission.)

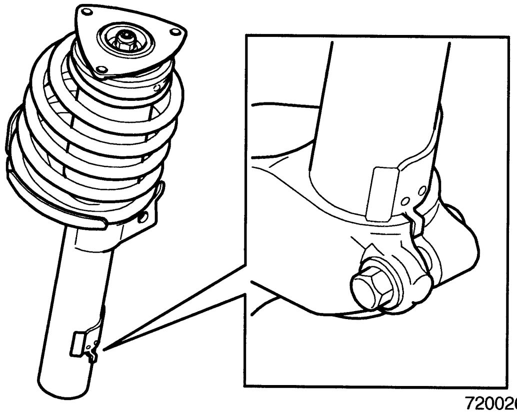


FRONT SUSPENSION

GENERAL

The front suspension consists of McPherson spring struts with L-shaped lower control arms secured in the stub axle and sub frame. The sub frame is made of sheet metal and suspended from the bodywork by four rubber mountings.

SPRING STRUT/SHOCK ABSORBER, STUB AXLE



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The shock absorbers are integrated into the spring struts.

The spring strut and stub axle are two separate units.

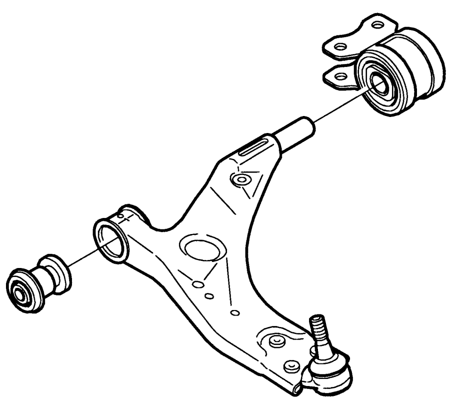
On the spring strut there is a guide that fits into the stub axle; the sections are secured with a bolt.

The upper spring mounting has one predetermined mounting position. On the mounting is a marking which must be opposite the guide on the spring strut.

The upper shock absorber bearing consists of individual ball bearings in a frame. The ball bearings are retained by the spring seat.

NOTE: When separating the bearing and seating the ball bearings can easily fall out.

LOWER CONTROL ARM



The lower control arm is made of stamped sheet steel and the ball joint is riveted to the control arm using three rivets.

The front bushing is a normal rubber bushing. The rear bushing is a hydro-bushing.

Replacing the Lower Control Arm

The control arm is only available as a complete assembly with a ball joint and front and rear bushings. If any of the components are damaged or worn, the lower control arm must be replaced as a complete unit.

Hydro - Bushing (fluid filled rubber bushing)

The bushing has a very large damping effect on small amplitude movement and certain frequency- such as, with brake vibration and wheel imbalance.

The large damping effect is caused by fluid in the bushing being forced through several narrow channels.

In movements above a certain amplitude, the pressure in the bushing increases making a bypass valve open. This means that maximum damping is restricted to low amplitude.

Wheel Alignment

The front wheels have toe-in, negative camber and positive caster.

Only the toe-in is adjustable - it is adjusted normally with the length of the track rods.

The suspension has a negative steering scrub radius which contributes to good directional stability, for example, while accelerating on an uneven surface.

Angle Compensation When Driving

Toe-in

The suspension is designed to give lateral understeer and roll understeer. This means the wheels are twisted slightly when they are exposed to lateral forces and when the car rolls. Understeer makes the car more stable (for example when cornering).

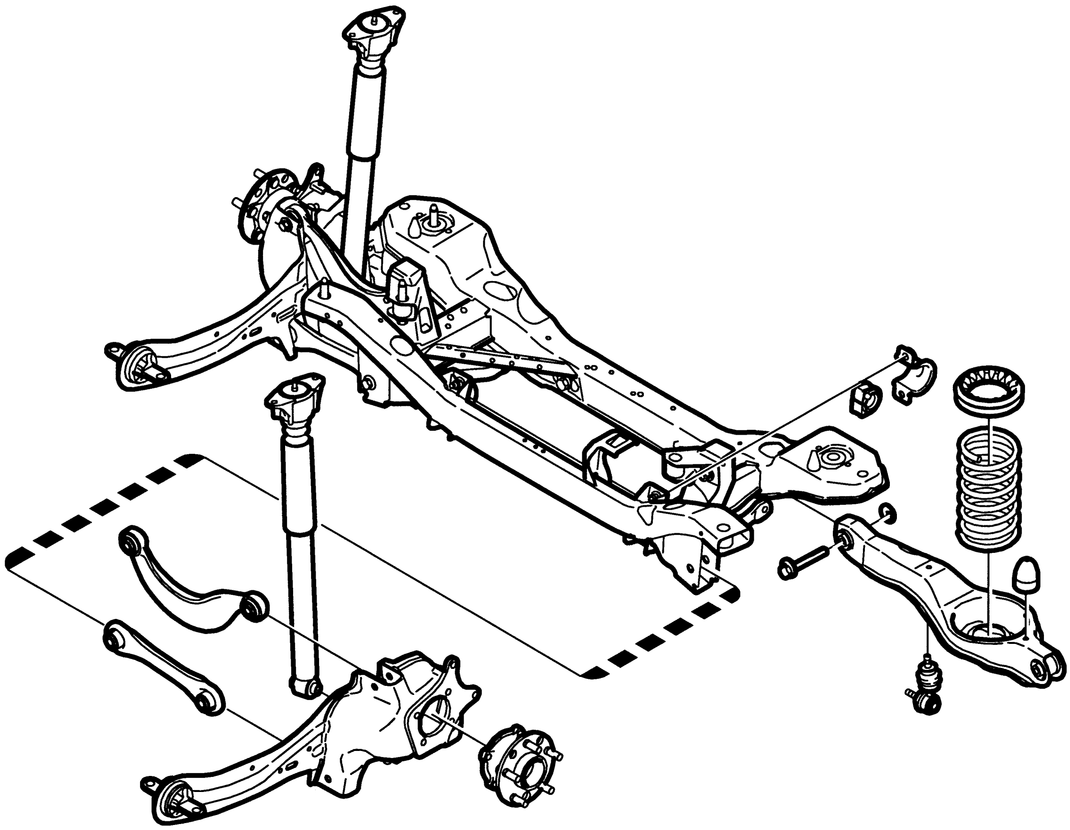
Example:

When cornering, the outer wheel is exposed to large lateral forces, the wheel is twisted out slightly (toe-in is reduced). When the car rolls, the wheel is twisted further out. In the same way the inner wheel is twisted slightly in.

Camber

The suspension is designed to give controlled change in the camber angle during roll/springing so the wheels always have good contact with the road surface.

When the wheel is sprung upward, the wheel will lean in more (= negative camber increases), and when the wheel is sprung downward the wheel leans more outward (= negative camber decreases).



REAR SUSPENSION

GENERAL

The rear wheel suspension is the multilink type with sub-frame, trailing arm, upper and lower control arms and track rods. The links are designed to give controlled wheel angles throughout movement. This gives progressive and stable steering reactions when cornering.

SUB-FRAME, CONTROL ARMS, SHOCK ABSORBERS

The sub frame is made of sheet steel and suspended from the side members.

The upper control arm is made of cast iron. The lower control arm and the track rod are made of sheet steel.

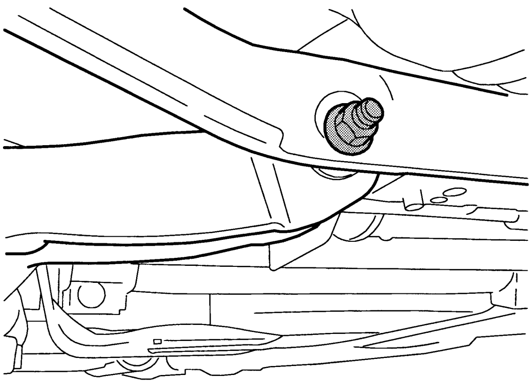
The trailing arm / stub axle is one unit and is made of sheet steel.

The bushings for the trailing arm and lower control arm are available as replacement parts.

The bushings for the upper control arm and track rod are not available as replacement parts. In the event of a worn bushing the control arm or track rod must be replaced as a unit.

Nivomat® shock absorbers are available as an option depending on the variant and market.
Nivomat® shock absorbers cannot be added because of trailing arm differences.

WHEEL ALIGNMENT



The rear wheels have toe-in and negative Camber.

Only the toe-in is adjustable - it is adjusted using an eccentric screw by the inner mounting on the lower control arm.

Angle Compensation When Driving

Toe-in

The suspension is designed to give lateral understeer and roll understeer. This means the wheels are twisted slightly when they are exposed to lateral forces and when the car rolls. Understeer makes the car more stable, for example when cornering.

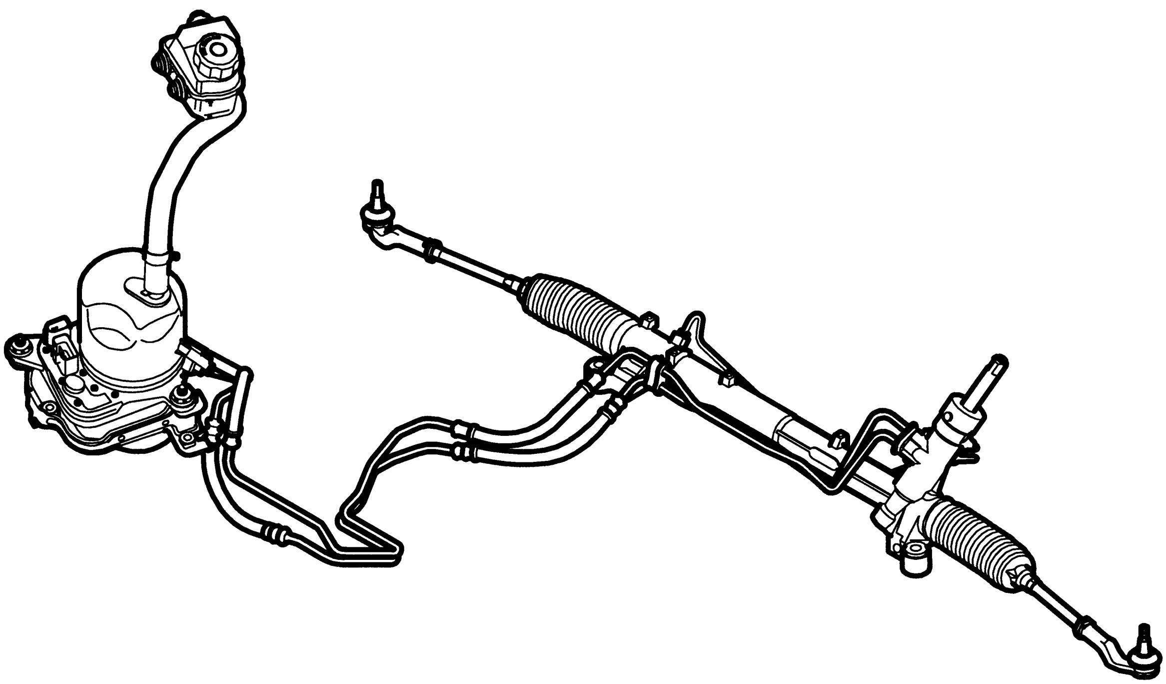
Example:

When cornering the outer wheel is exposed to large lateral forces, the wheel is twisted in slightly (toe-in increases). When the car rolls the wheel is twisted further in. In the same way the inner wheel is twisted slightly out.

Camber

The suspension is designed to give controlled change in the camber angle during roll/springing so the wheels always have good contact with the road surface.

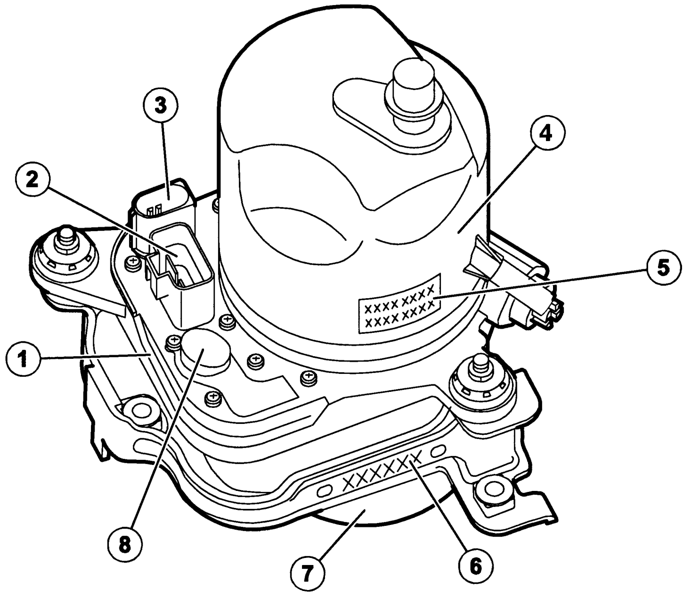
When the wheel is sprung upwards the wheel will lean in more (= negative camber increases), and when the wheel is sprung downward the wheel leans more outward (= negative camber decreases).



POWER STEERING - EHPAS

EHPAS (Electro Hydraulic Power Assisted Steering)

The system has a hydraulic pump driven by an electric motor. The electric motor is controlled by the control module. The control module adapts the servo power based on the speed of the car and how fast the steering wheel is being turned.



1	Control module with power stage	5	Label with P/N
2	Connector +30 and ground	6	Serial number supplier (unique for each unit)
3	Connector for +15 and CAN	7	Electric motor
4	Fluid reservoir and hydraulic pump	8	Moisture valve

Control module, electric motor, hydraulic pump and fluid reservoir are all in one unit-which is also a replacement part.

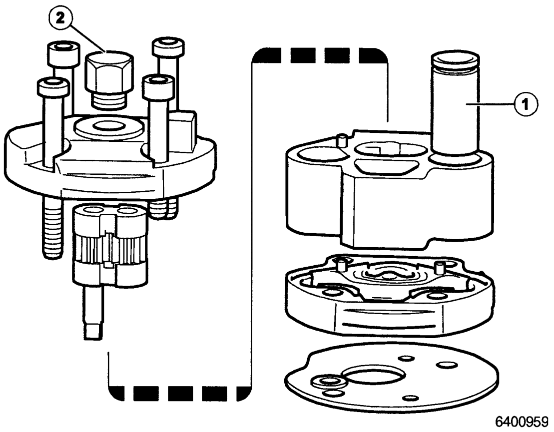
The unit is positioned under the right-hand front wing.

Some advantages of this type of system are:

- Using software, servo power can be easily adapted to different car variants.
- Takes up very little space and easy to position in the car.
- No drive belt is required.
- Energy consumption is lowered, which leads to reduced fuel consumption.

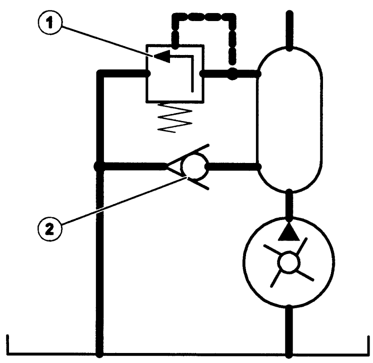
COMPONENTS

Hydraulic Pump



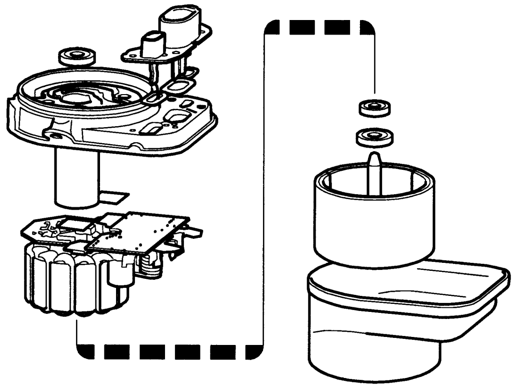
The pump is the gear type.
Maximum assist pressure is 120 bar.

There is a bypass valve (1) and a check valve (2) integrated in the pump.



The bypass valve (1) opens when the pressure is too high and the oil is returned via the check valve (2) to the pump.

Pump Motor



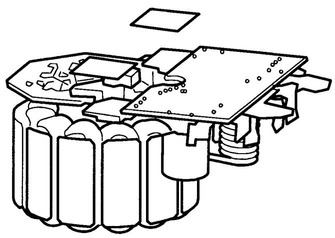
The pump motor is a brushless direct current (DC) motor with four rotor windings.

The speed of the motor is controlled by the control module using PWM. A hall sensor in the motor informs the control module of the actual speed and indirectly the relevant hydraulic pressure.

The speed can vary between approximately 1300 and 4500 rpm as required.

CONTROL MODULE (EPS)

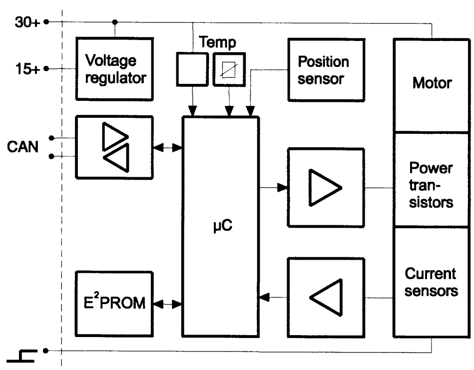
All the functions for controlling and monitoring the system are in the EPS.
When replacing the EPS, software must be downloaded to adapt the servo control to the vehicle profile.
If the software is not downloaded, servo power will be for a general vehicle profile. In addition, a diagnostic trouble code (DTC) is stored.



Speed, Power Consumption

EPS controls the speed of the pump motor and power consumption via internal power stages - power transistors.

The power consumption can vary between 6 and 80 A depending on the conditions. A diagnostic trouble code (DTC) is stored if consumption is greater than 96 A.



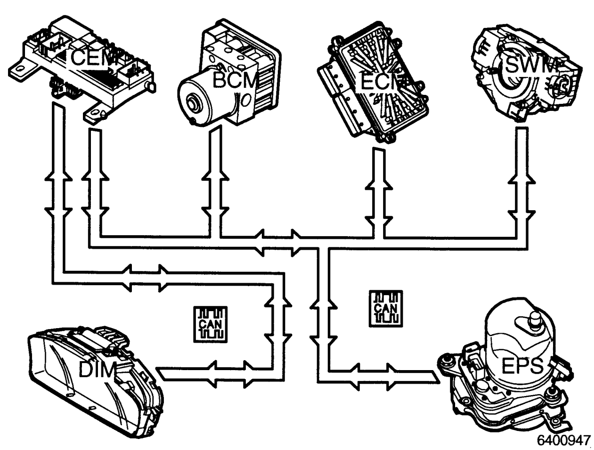
Temperature

The EPS calculates the temperature in the power stages. If the temperature is too high (above 175°C) the power is limited.

There is a temperature sensor (NTC) in the EPS which senses the temperature in the control module.

High temperature
Above 110°C at the self test = the pump does not start.
Above 120°C while driving = the pump is shut off.

Low temperature
The speed of the motor is reduced to limit the servo power. This is because the viscosity of the hydraulic fluid, and therefore pressure, increases at low temperatures.



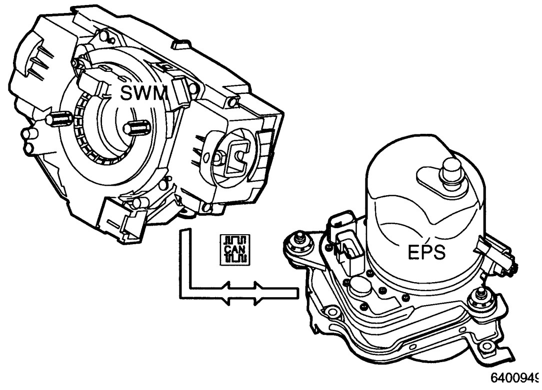
Communication

EPS communicates with a number of other control modules via the CAN:

- CEM
- BCM
- ECM
- SWM
- DIM

Communication with DIM is described in the 'Diagnostic' section.

INPUT SIGNALS

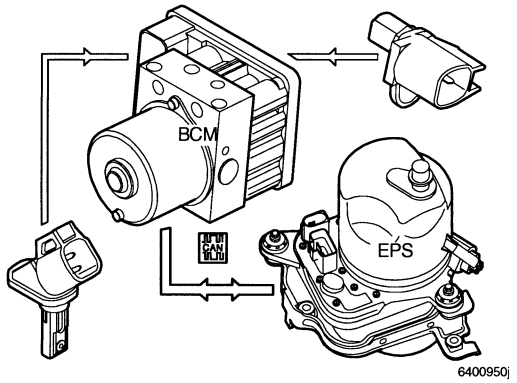


Steering Wheel Movement Speed

Signal from the steering wheel angle sensor in the SWM:

- Provides information about how fast the steering wheel is turned in degrees/s.

The servo effect is adapted to the speed that the steering wheel is turned. The faster the steering wheel is turned the more servo power provided.

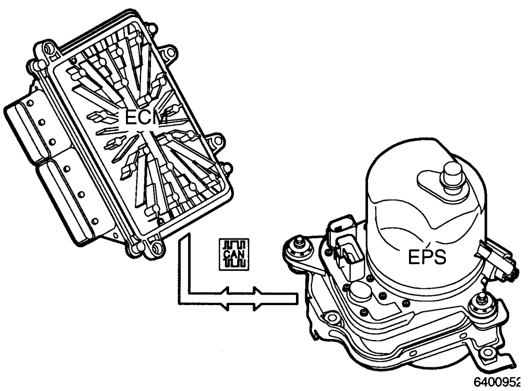


Vehicle Speed

Signal from BCM:

- Provides information about the speed of the vehicle.

Servo power is adapted to the speed. The higher the speed the lower the servo power.



Engine Status And Speed

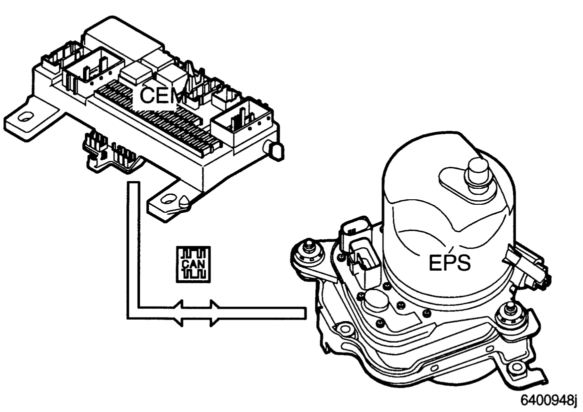
Signals from ECM:

- Provides information if the engine is running or not.

The pump motor normally only starts with the engine running.

If the engine status signal is missing the engine speed signal from the ECM is used.

If both signals are missing the pump motor will start when the ignition is switched on.

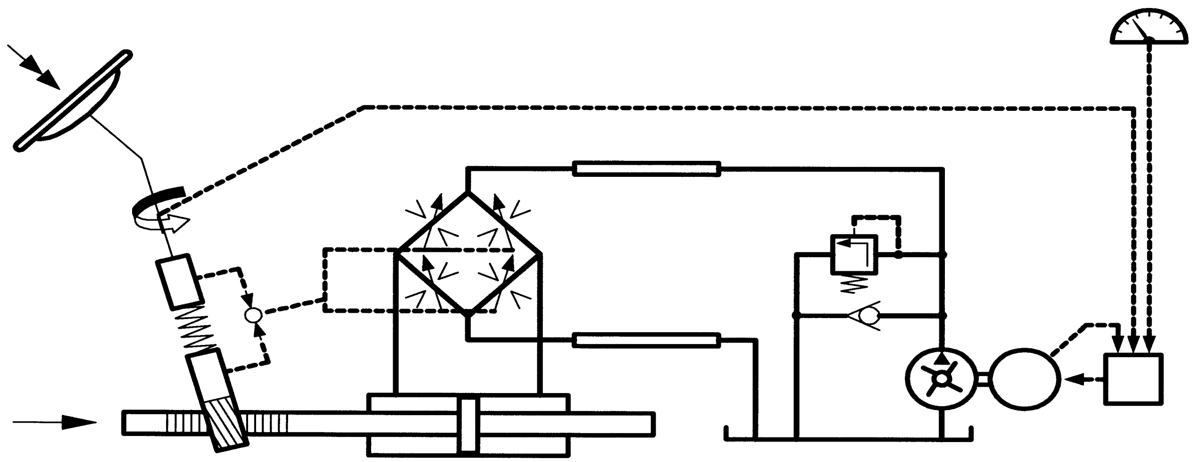


Identifying EPS

A configuration ID for the EPS is stored in both the CEM and the EPS.

These IDs are compared and must correspond for the system to function.

OIL FLOW, PRESSURE

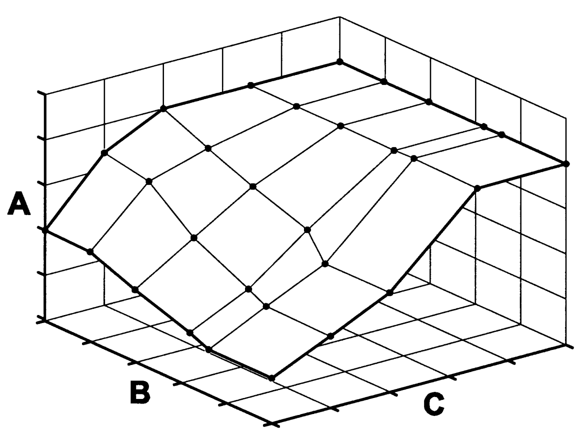


When no servo assistance is required, all four valves in the steering gear valve housing are open.

The oil then only circulates at low pressure from the pump, via the valve housing for the steering gear back to the oil reservoir.

When the steering wheel is turned, two of the valves in the valve housing are closed - which two valves is dependent on the direction the steering wheel is turned.

Oil under pressure is then forced into one side of the steering gear and drained from the other side of the steering gear - servo force is obtained. EPS adjusts the speed of the electric motor as necessary.



This is based mainly on the speed of the car and how fast the steering wheel is being turned.

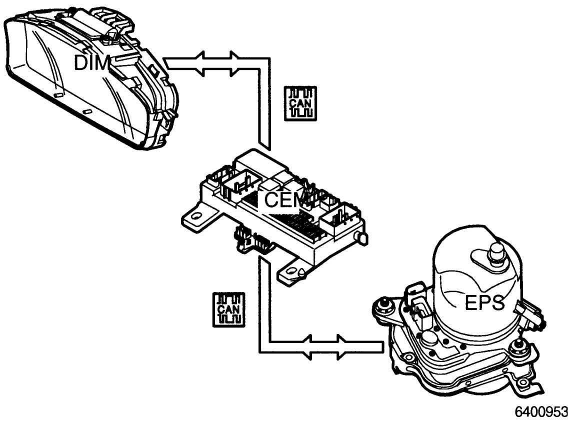
Example on the diagram of electric motor speed:

A. Electric motor speed
B. Vehicle speed
C. Steering wheel speed (how fast the steering wheel is turned)

DIAGNOSTICS

The EPS has a built-in diagnostic system which monitors internal functions and input and output signals.

The diagnostic starts when the ignition is switched on (15+) and a self-test is done. If no faults are found the pump starts when the start conditions are met (see below). The diagnostic continuously monitors the system.



The control module will store a DTC if it detects a fault.

In certain cases the incorrect/missing signal is replaced by a substitute value or certain functions, such as controlling pump speed, are restricted.

For certain DTCs, a request is also transmitted to DIM, via GEM, to light the general information lamp and to display a text message in the display.

When the fault is no longer active, a request to switch off the general information lamp and text message is transmitted in the same way.

Start Conditions for the Pump

The pump starts if the following conditions are met:

- 15+ is high (ignition on).
- 30+ supply is between 10.5 and 16.5 V.
- The car engine has started.

If the vehicle speed is more than 15 km/h when the above conditions are met, the pump speed will increase gradually for 20 seconds.

Stop Conditions for the Pump

The pump switches off if one of the following occurs:

- 15+ is low (ignition off).
- 30+ supply is below 9.0 V.
- If the EPS receives the signal 'Engine not running' from the ECM.

  If this signal is sent when vehicle speed is more than 15 km/h, the pump speed will decrease gradually to 0 in approximately 20 seconds.