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The 2001 EuroVan

With the 2.8-Liter 24-Valve VR6 Engine and Electronic Stabilization Program

Self-Study Program
Course Number 892103

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Always check Technical Bulletins and the Volkswagen Worldwide Repair Information System for information that may supersede any information included in this booklet.

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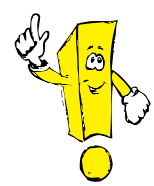
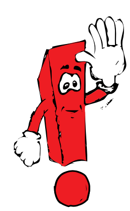
New !



Important/Note!



The Self-Study Program provides you with information regarding designs and functions.

The Self-Study Program is not a Repair Manual!

For maintenance and repair work, always refer to the current technical literature.

2001 EuroVan

892103/002

The 2001 EuroVan is the continuation of the tradition begun in 1950 with the original Volkswagen Transporter. Today's version offers many new features to increase driveability, passenger comfort, and safety.

Four versions of the EuroVan will be offered for the U.S. market. These are the GLS, MV, MV Weekender, and the EuroVan Camper. Three versions will be offered in the Canadian market; the GLS, MV, and MV Weekender. The EuroVan Camper will not be offered in Canada.

New features include a new 2.8-liter 24-valve VR6 engine, with four valves per cylinder and variable valve timing, developing 201 horsepower (150 kW).

The addition of the Electronic Stabilization Program (ESP) marks the first use by Volkswagen in the North American market of this important safety feature.

GLS and MV

892103/003

New equipment for the GLS and MV includes:

Engine
- 2.8L 201 hp (150 kW), 181 lbs-ft (245 Nm) torque, 6-cylinder VR6 24-valve, 15° V, gas
- Enhanced On-Board Diagnostics (OBD II)

Emissions
- On-board Refueling Vapor Recovery (ORVR)
- Transitional Low Emissions Vehicle (TLEV) emissions concept
- Premium unleaded fuel required

Traction Control
- Anti-Slip Regulation (ASR) and Electronic Stabilization Program (ESP)

Front Brakes
- New 300 mm front brakes (from 280 mm)

Lights, Front/Rear
- Front foglights (without washers)

Tires
- P225/60 R 16 H, all season

Wheels/Covers
- New 16” alloy wheels (from 15”)

Theft Deterrent
- Immobilizer III theft deterrent system

Doors
- Lockable storage box in left door

Keys
- Folding key with new design

Radio/Audio
- Premium V, 6-speaker AM/FM cassette stereo sound system

Restraint System
- Child seat tether anchorage points, third row (FMVSS 225)

Seating, Rear
- Two individual middle row seats replacing bench (GLS only)

MV Weekender

892103/004

New equipment for the MV Weekender includes:

Engine

- 2.8L 201 hp (150 kW), 181 lbs-ft (245 Nm) torque, 6-cylinder VR6 24-valve, 15° V, gas
- Enhanced On-Board Diagnostics (OBD II)

Emissions

- On-board Refueling Vapor Recovery (ORVR)
- Transitional Low Emissions Vehicle (TLEV) emissions concept
- Premium unleaded fuel required

Traction Control

- Anti-Slip Regulation (ASR) and Electronic Stabilization Program (ESP)

Front Brakes

- New 300 mm front brakes (from 280 mm)

Lights, Front/Rear

- Front foglights (without washers)

Tires

- P225/60 R 16 H, all season

Wheels/Covers

- New 16” alloy wheels (from 15”)

Theft Deterrent

- Immobilizer III theft deterrent system

Doors

- Lockable storage box in left door

Keys

- Folding key with new design

Radio/Audio

- Premium V, 6-speaker AM/FM cassette stereo sound system

Restraint System

- Child seat tether anchorage points, third row (FMVSS 225)

Introduction

EuroVan Camper*

892103/005

New equipment for the EuroVan Camper includes:

Engine
- 2.8L 201 hp (150 kW), 181 lbs-ft (245 Nm) torque, 6-cylinder VR6 24-valve, 15° V, gas
- Enhanced On-Board Diagnostics (OBD II)

Emissions
- On-board Refueling Vapor Recovery (OVR)
- Transitional Low Emissions Vehicle (TLEV) emissions concept
- Premium unleaded fuel required

Front Brakes
- New 300 mm front brakes (from 280 mm)

*Camper not available in Canada.

Lights, Front/Rear
- Front foglights (without washers)

Tires
- P225/60 R 16 H, all season

Theft Deterrent
- Immobilizer III theft deterrent system

Doors
- Lockable storage box in left door

Keys
- Folding key with new design

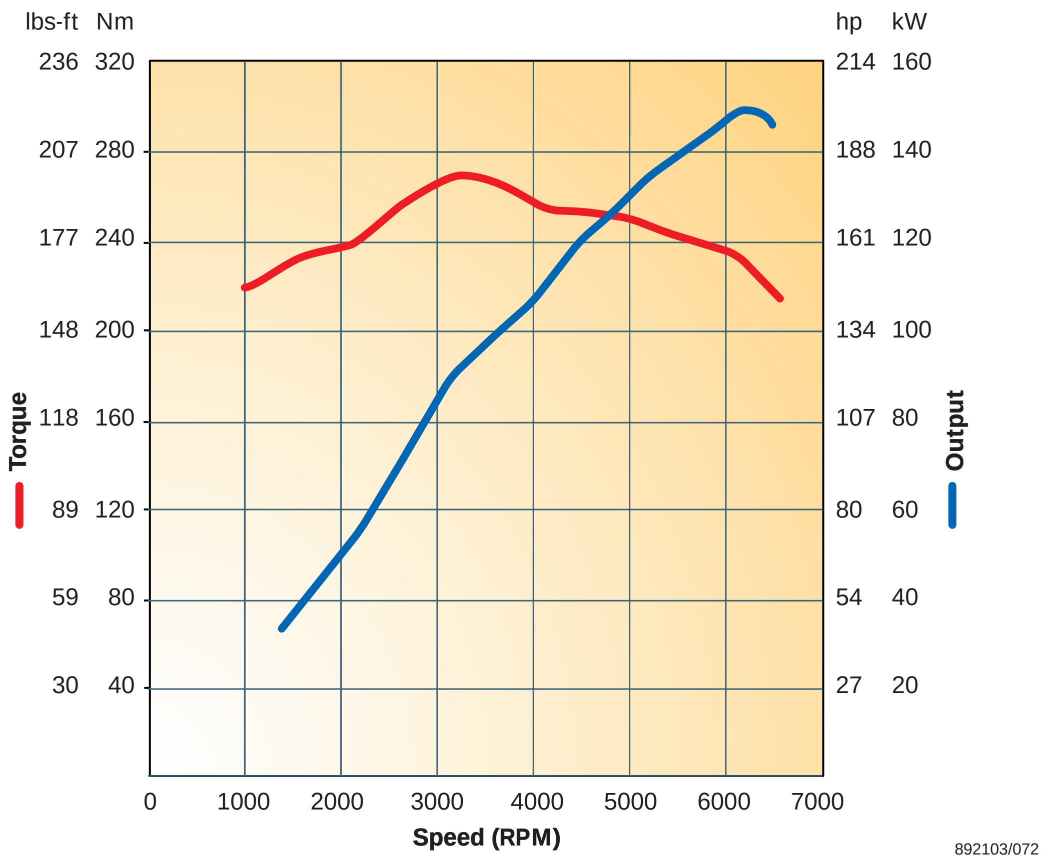
Restraint System
- Child seat tether anchorage points, third row (FMVSS 225)

The 2.8-Liter 6-Cylinder 24-Valve Engine

The 6-cylinder 24-valve engine is a development of the previous generation 15-degree VR6. The main mechanical differences are in the cylinder head area due to the introduction of four valves per cylinder. Another new feature is the introduction of a new variable valve timing system, enabling the intake and exhaust cams to be controlled independently. The variable intake manifold already in use on Golf and Jetta models equipped with the VR6 engine is being introduced for the first time on the EuroVan.

The Technical Data

Engine Code	AXK
Design	6-cylinder four-stroke, 15° V
Bore	3.19 in (81.0 mm)
Stroke	3.54 in (90.3 mm)
Displacement	170.3 cu in (2792 cm^3)
Compression Ratio	10.0 : 1
Maximum Power	201 hp (150 kW) @ 6200 rpm
Maximum Torque	181 lbs-ft (245 Nm) @ 4500 rpm
Engine Management System	Motronic ME7.1
Fuel Requirements	Premium Unleaded Gasoline (91 AKI recommended)

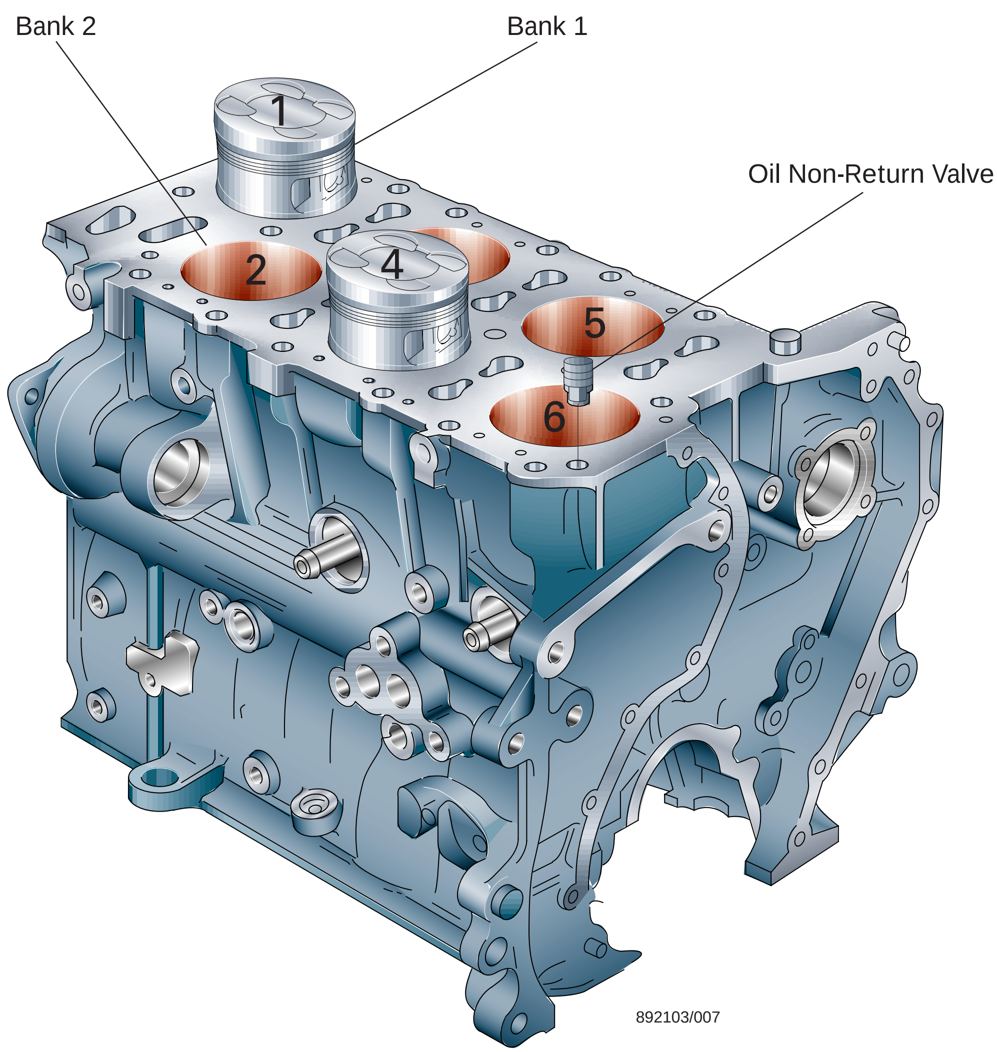


Block and Pistons

The layout of the block is identical to that of the previous 15-degree VR6 engine. It is made from gray cast iron with six cylinders divided in two banks. The cylinder numbering begins at the side opposite the flywheel and on bank 1.

The pistons have a new design and the combustion chamber is located in the cylinder head. On previous versions, the combustion chamber was located in the piston crown.

The piston crowns have four recesses to prevent impact with the valves. The recesses for the intake valves are deeper than for the exhaust valves and should be installed facing the inside of the V on the block.



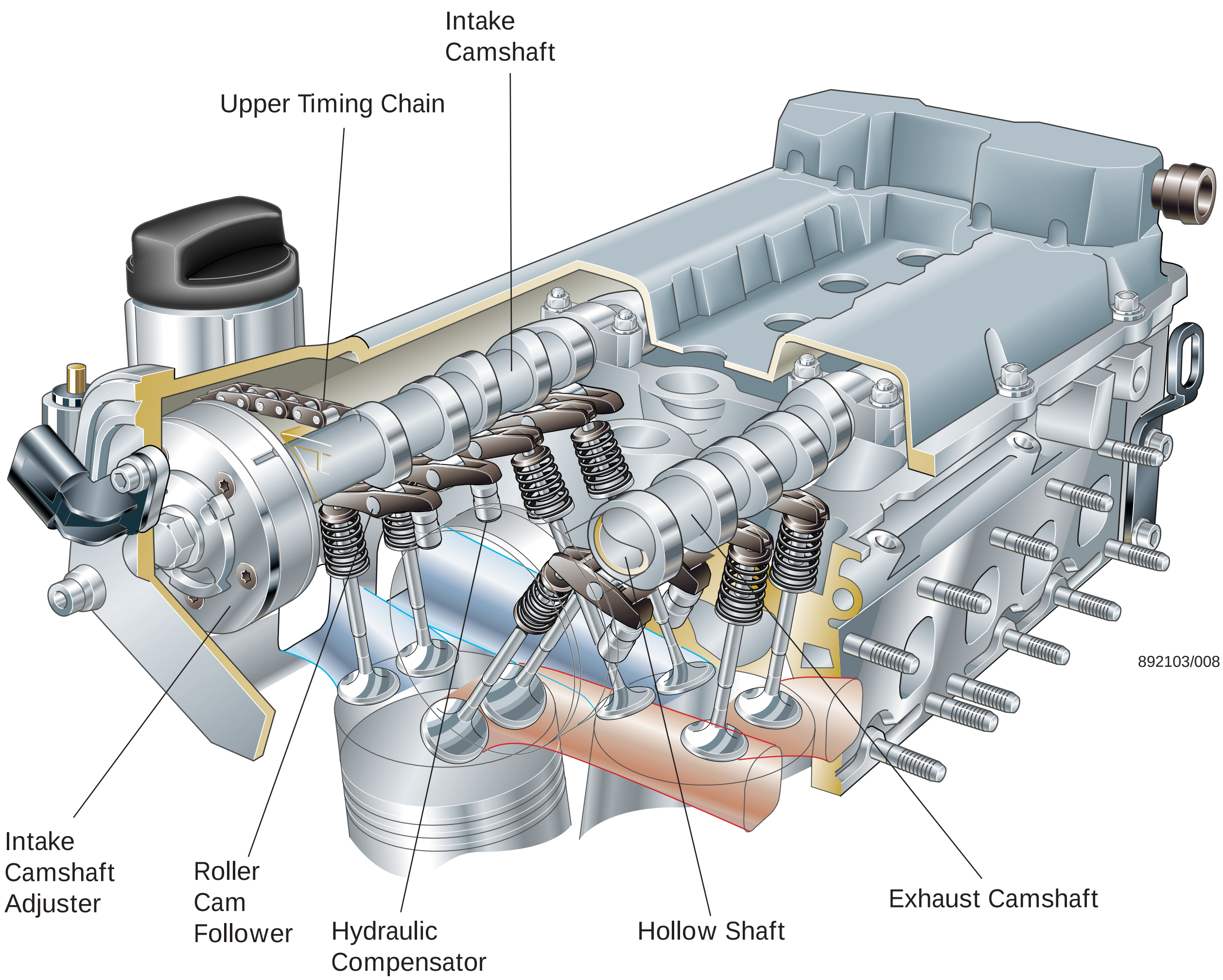
Cylinder Head

The cylinder head is a cross-flow type and has four valves per cylinder. It has two camshafts, one exhaust and one intake, connected by the upper timing chain.

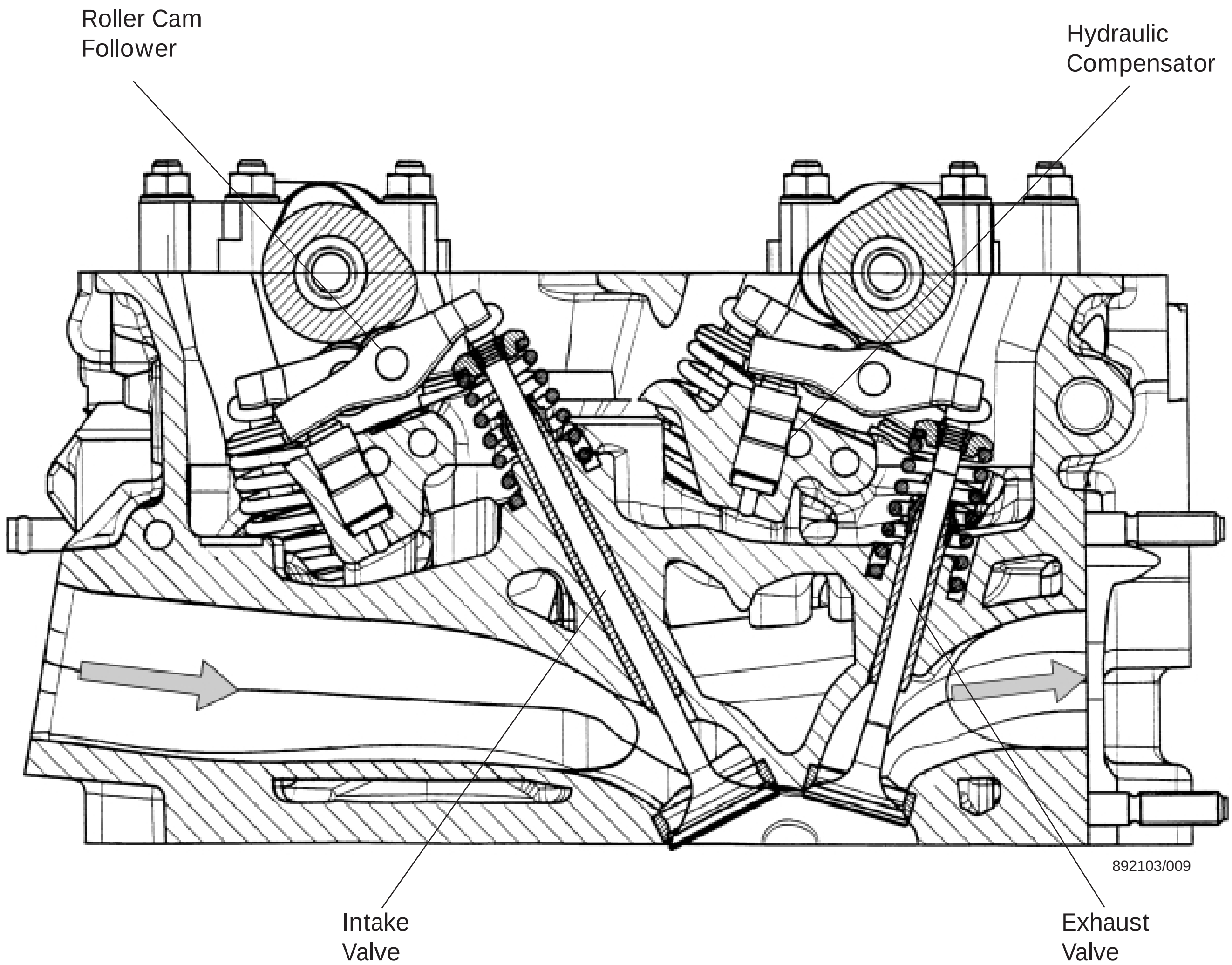
The manufacturing technique used for the camshafts is completely new, since the shafts are hollow with separate cam lobes. These are press fitted on the cam during manufacture using hydraulic pressure (hydro-forming).

The advantages of this camshaft manufacturing technique are:

- Reduction of weight for the hollow shaft
- Use of material with resistance to bending for the shaft
- Use of material with specific friction characteristics for the cams



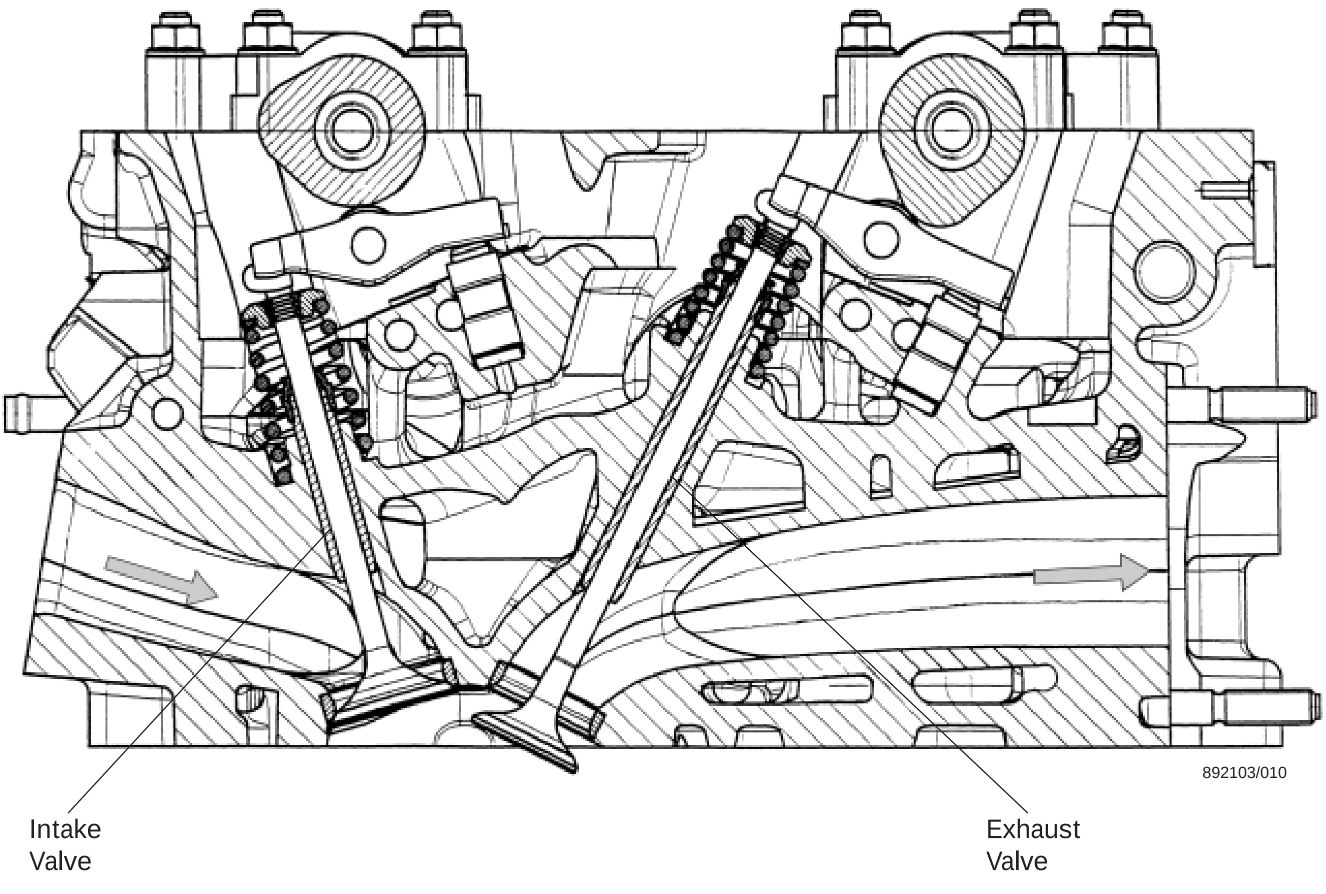
In order for each camshaft to operate valves in both cylinder banks, the valve stems have different lengths to compensate for the difference in the distance between the cams and the cylinder banks.



Cylinder Head Cross-Section View, Cylinders 1, 3, and 5

The valves are actuated by rocker arms with integral roller cam followers, and hydraulic compensating units. Therefore, no maintenance adjustments are required.

The intake and exhaust manifolds for each cylinder bank have different cross-sections to ensure that both cylinder banks receive the same air speed and volume.



Cylinder Head Cross-Section View, Cylinders 2, 4, and 6

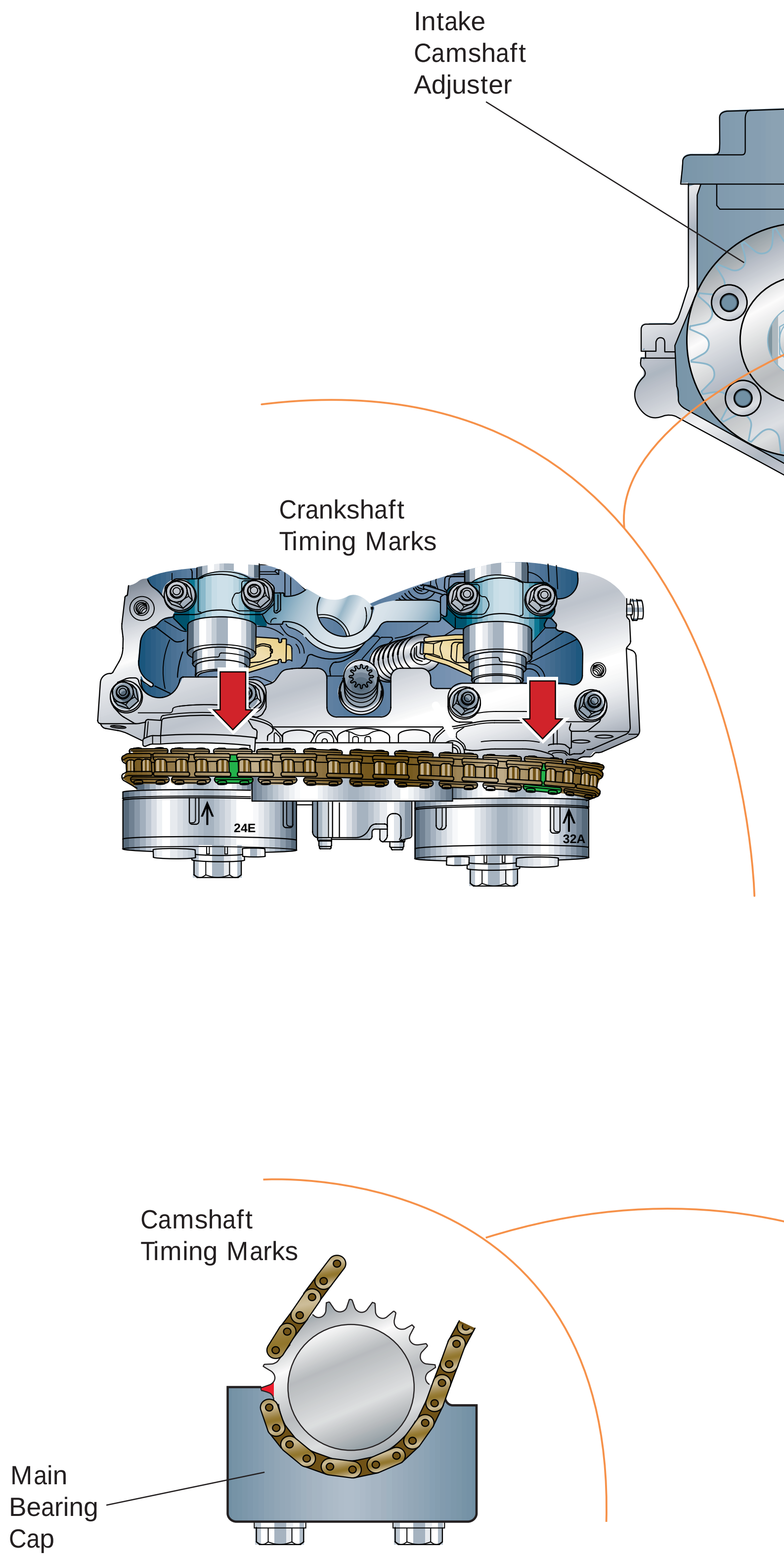
Valve Train Operation

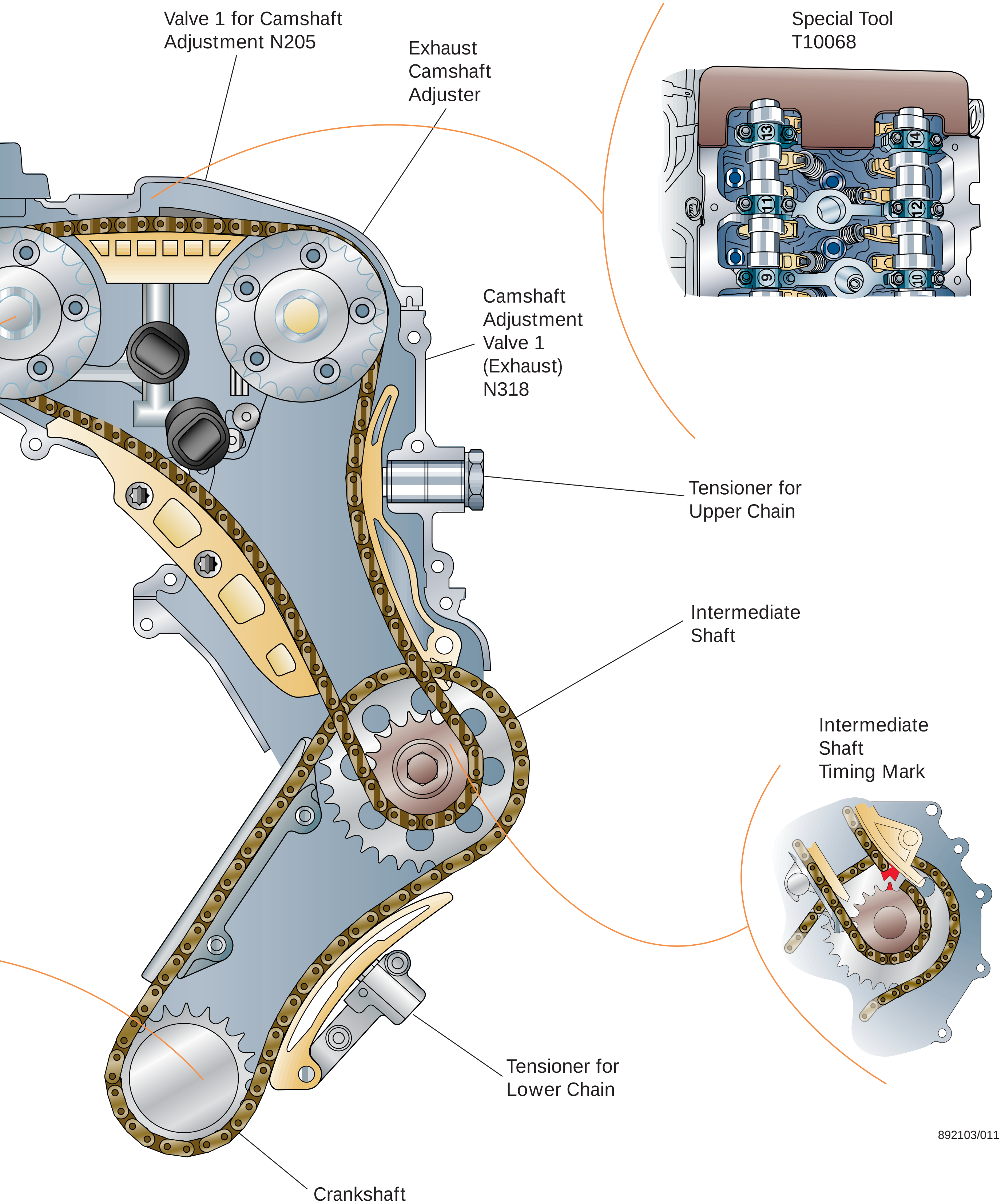
The timing mechanism is operated by two chains, two hydraulic tensioners, and five sprockets, one for each camshaft, one on the crankshaft, and two on the intermediate shaft.

The lower chain connects the crankshaft to the intermediate shaft, and the upper chain transmits the movement from the intermediate shaft to the camshafts. Tension on each chain is maintained by an automatic hydraulic tensioner.

The tensioners and timing marks for the upper and lower chains are similar to those on the previous 2.8-liter VR6 engine. Special tool T10068 is needed to lock the two camshafts when doing the timing. When the camshafts or timing adjusters are dismantled and reassembled, they must be synchronized.

Therefore, it is necessary to locate both timing adjusters in the setup position when installing them to the camshafts. The chain must then be installed so that the plated links of the top chain coincide with the marks on the sprockets.




Valve 1 for Camshaft Adjustment N205
Exhaust Camshaft Adjuster
Special Tool T10068
Camshaft Adjustment Valve 1 (Exhaust) N318
Tensioner for Upper Chain
Intermediate Shaft
Intermediate Shaft Timing Mark
Tensioner for Lower Chain
Crankshaft
892103/011

Variable Valve Timing

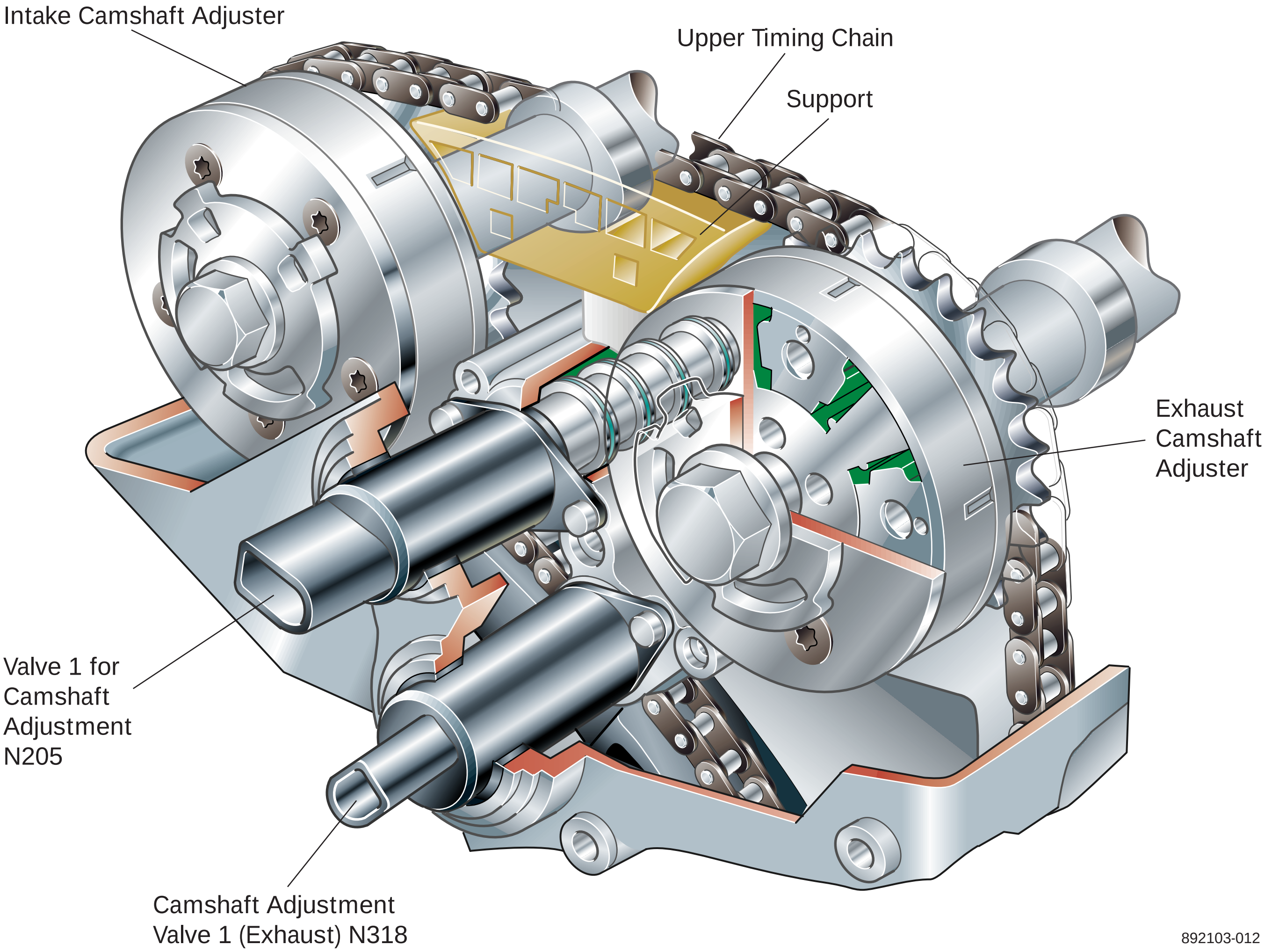
All the components relating to the variable timing system are located in the cylinder head, at the flywheel side of the engine.

The system is composed of a support, which houses the various oil passages, two camshaft adjusters, two solenoids (Valve 1 for Camshaft Adjustment N205 and Camshaft Adjustment Valve 1 (Exhaust) N318), and the upper timing chain, which transmits movement from the intermediate shaft to both camshafts.

The variable timing system allows the opening and closing points of the exhaust and intake valves to be modified independently.

The camshaft timing adjustment is accomplished using a hydraulic circuit which passes oil pressure to the timing adjusters. This is achieved with the aid of the two solenoids. Valve 1 for Camshaft Adjustment N205 controls the passage of oil to the intake cam, and Camshaft Adjustment Valve 1 (Exhaust) N318 controls the passage of oil to the exhaust cam.

The Motronic Engine Control Module J220 governs the operation of both solenoids.



Both timing adjusters consist of the same components:

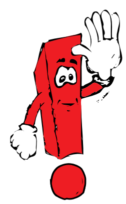
- Sprocket
- Base cylinder
- Rotor
- Cover
- Camshaft position sensor reluctor

The sprocket, base cylinder and cover are bolted together in a single assembly and driven by the upper timing chain.

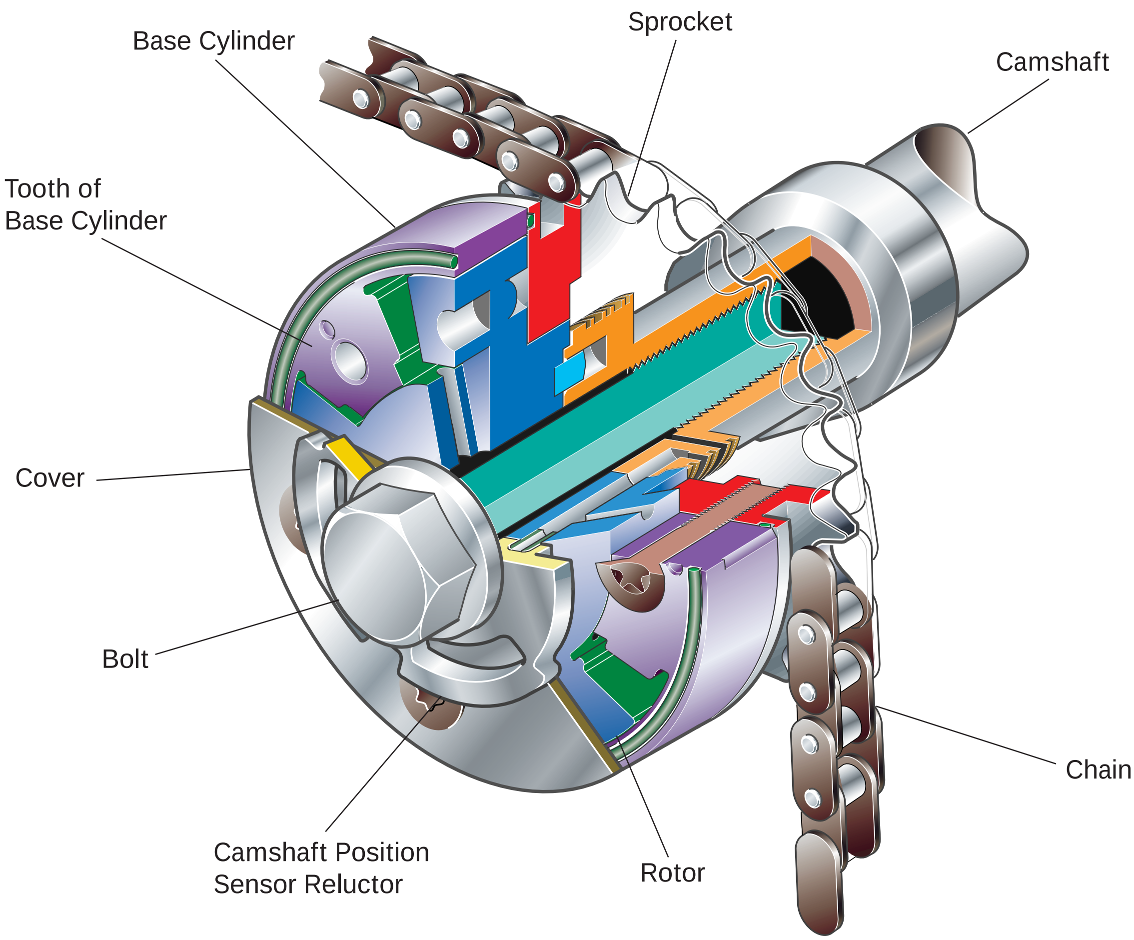
The rotor and the camshaft position sensor reluctor are fixed to the camshaft by the mounting bolt. The mounting position of these components is unique and set with the aid of locating lugs.

The position of the rotor in relationship to the base cylinder is modified by the oil pressure controlled by the two solenoids. The movement of the rotor, which also rotates the camshaft, is limited by the width of the chambers in the base cylinder.

The chambers for the intake and exhaust on the base cylinder have different widths, consequently the intake cam shaft can rotate up to 25° (50° of crankshaft) while the exhaust camshaft can only rotate 11° (22° of crankshaft) from its initial position.



More information on the function of camshaft position sensors can be found in the Motronic ME 7 system section of this SSP.



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The oil pressure from the pump reaches the solenoids through different passages. To ensure proper system operation, a minimum oil pressure of 10 psi (70 kPa) is required.

The solenoids direct oil to the A or B chambers in the camshaft adjusters.

When there is pressure in the A chambers, the rotor will remain in its initial position.

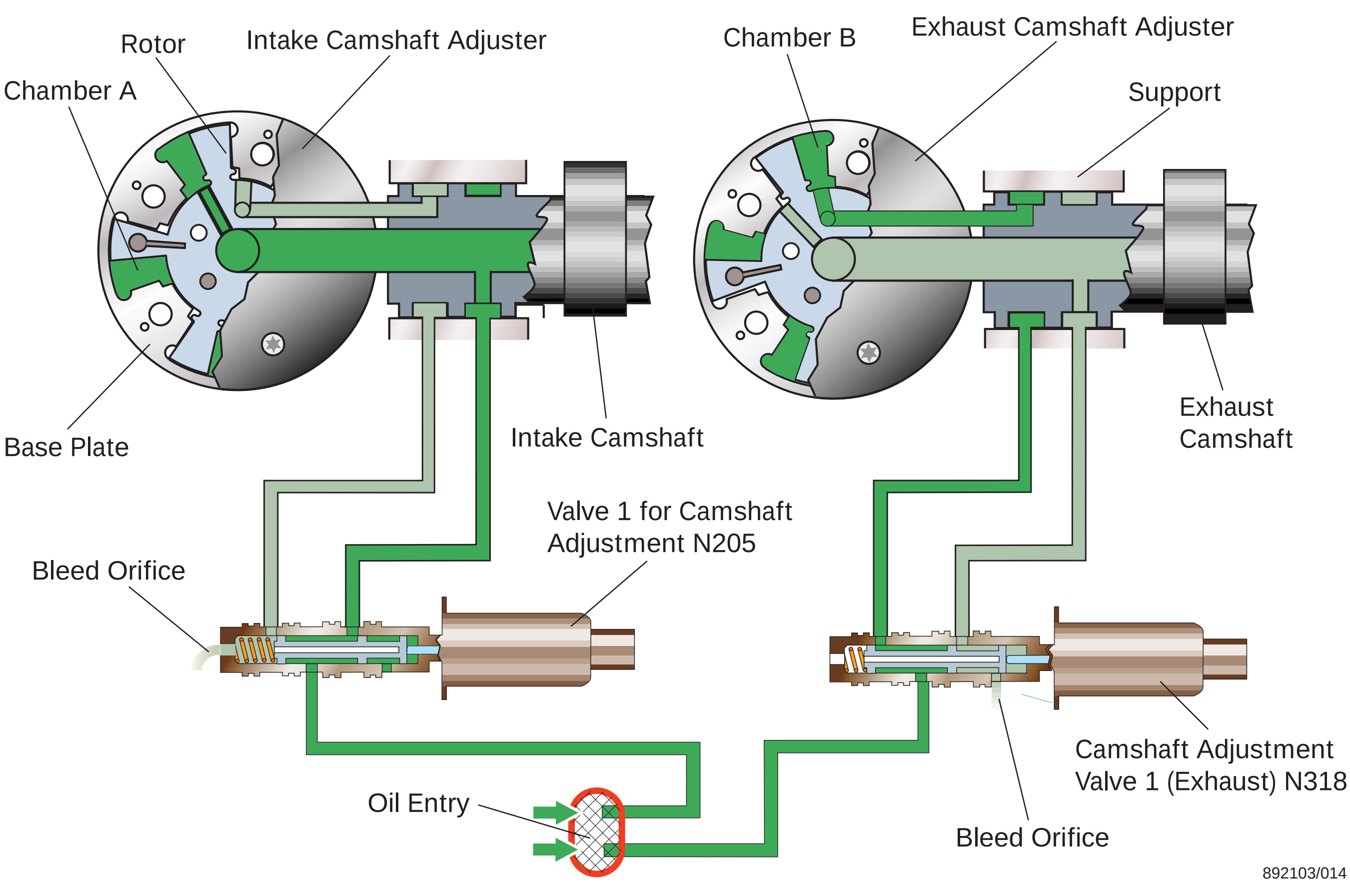
When the pressure is directed to the B chambers, the rotor moves and advances the opening and closing of the valves.

The solenoids have bleed orifices through which the oil from the non-pressurized camshaft adjuster chambers can escape during rotation of the rotor.

Idling Position

When the engine is idling or running at less than 1200 rpm and under light load, the Valve 1 for Camshaft Adjustment N205 will be in the rest position. It will direct oil pressure to the A chambers of the intake camshaft adjuster, to maintain the intake rotor in its initial position. Consequently, the intake valves will open 25° after top-dead-center (TDC).

During this operating condition, when the speed does not exceed 1200 rpm, the Camshaft Adjustment Valve 1 (Exhaust) N318 is energized and oil pressure reaches the B chambers of the exhaust camshaft adjuster, causing the exhaust rotor to move. This provokes an advance of 22° in the closing of the exhaust valves, or in other words, closure 25° before TDC.



Working Position

When the engine is running above 1200 rpm and under load, the position of the intake camshaft will be gradually modified, while the exhaust camshaft is returned to its initial position of 3° before TDC.

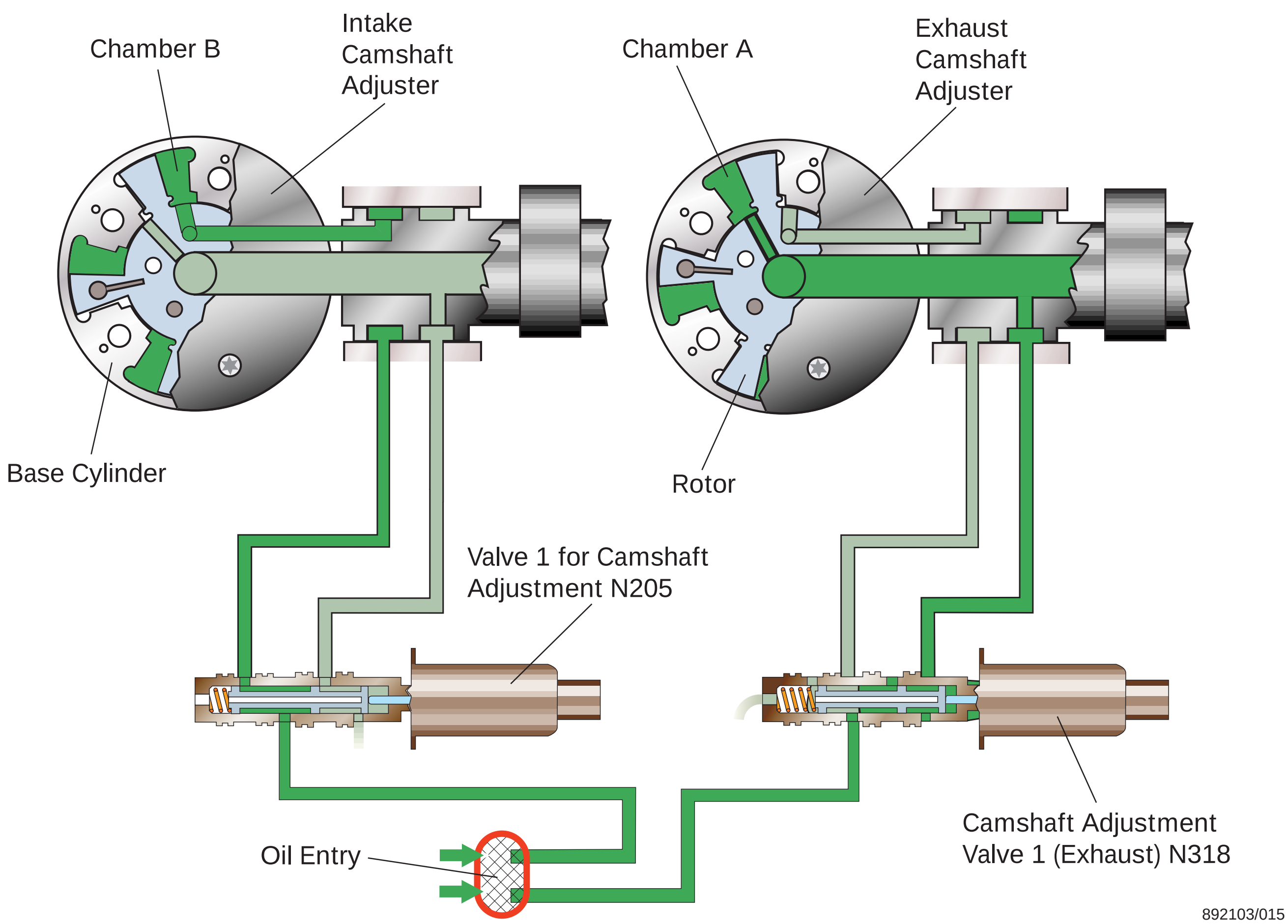
Valve 1 for Camshaft Adjustment N205 is energized and it opens the oil passages to the B chambers of the intake camshaft adjuster.

When the oil pressure reaches the B chambers, the rotor advances the intake camshaft and consequently the opening point of the intake valves. The maximum advance from the initial position is 50° or 25° before TDC.

The intake valves can operate at any point between the idling position of 25° after TDC and the maximum load position of 25° before TDC.

Whenever the engine runs above 1200 rpm, the Motronic Engine Control Module J220 will deactivate the Camshaft Adjustment Valve 1 (Exhaust) N318 and allow oil pressure to pass to the A chambers of the exhaust camshaft adjuster.

Under these circumstances, the exhaust camshaft adjuster rotor will remain in the initial position and the exhaust valves will close 3° before TDC.



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The variable timing is governed by the Motronic Engine Control Module J220. It uses the information from the following sensors for this purpose:

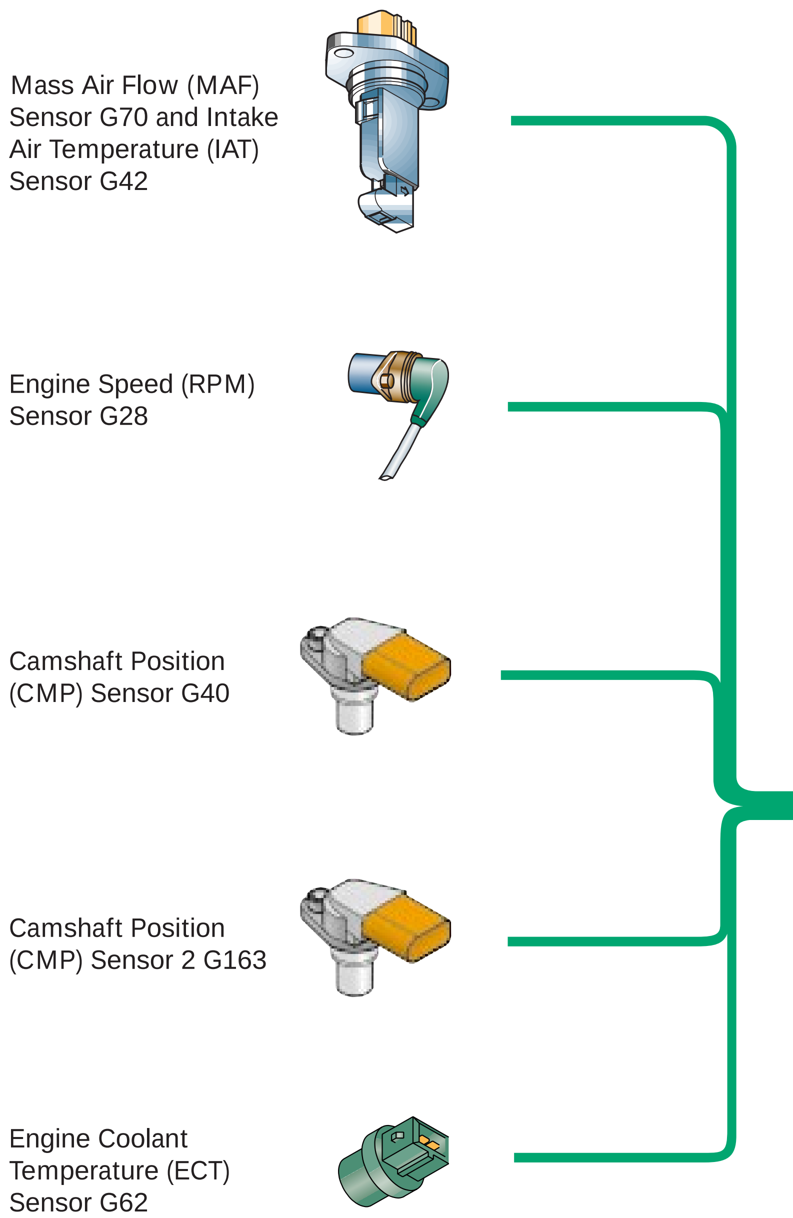
- Mass Air Flow (MAF) Sensor G70
- Engine Speed (RPM) Sensor G28
- Camshaft Position (CMP) Sensor G40
- Camshaft Position (CMP) Sensor 2 G163
- Engine Coolant Temperature (ECT) Sensor G62

The Camshaft Adjustment Valve 1 (Exhaust) N318 which controls the passage of oil to the exhaust camshaft adjuster is switched by the Motronic Engine Control Module J220. It has two states, energized and at rest. Under these circumstances, the Motronic Engine Control Module J220 switches the Camshaft Adjustment Valve 1 (Exhaust) N318 using a ground signal when the engine is running below 1200 rpm and under light load.

The Valve 1 for Camshaft Adjustment N205, which controls the passage of oil to the intake camshaft adjuster, is energized by the Motronic Engine Control Module J220 with a fixed frequency and a variable negative duty cycle.

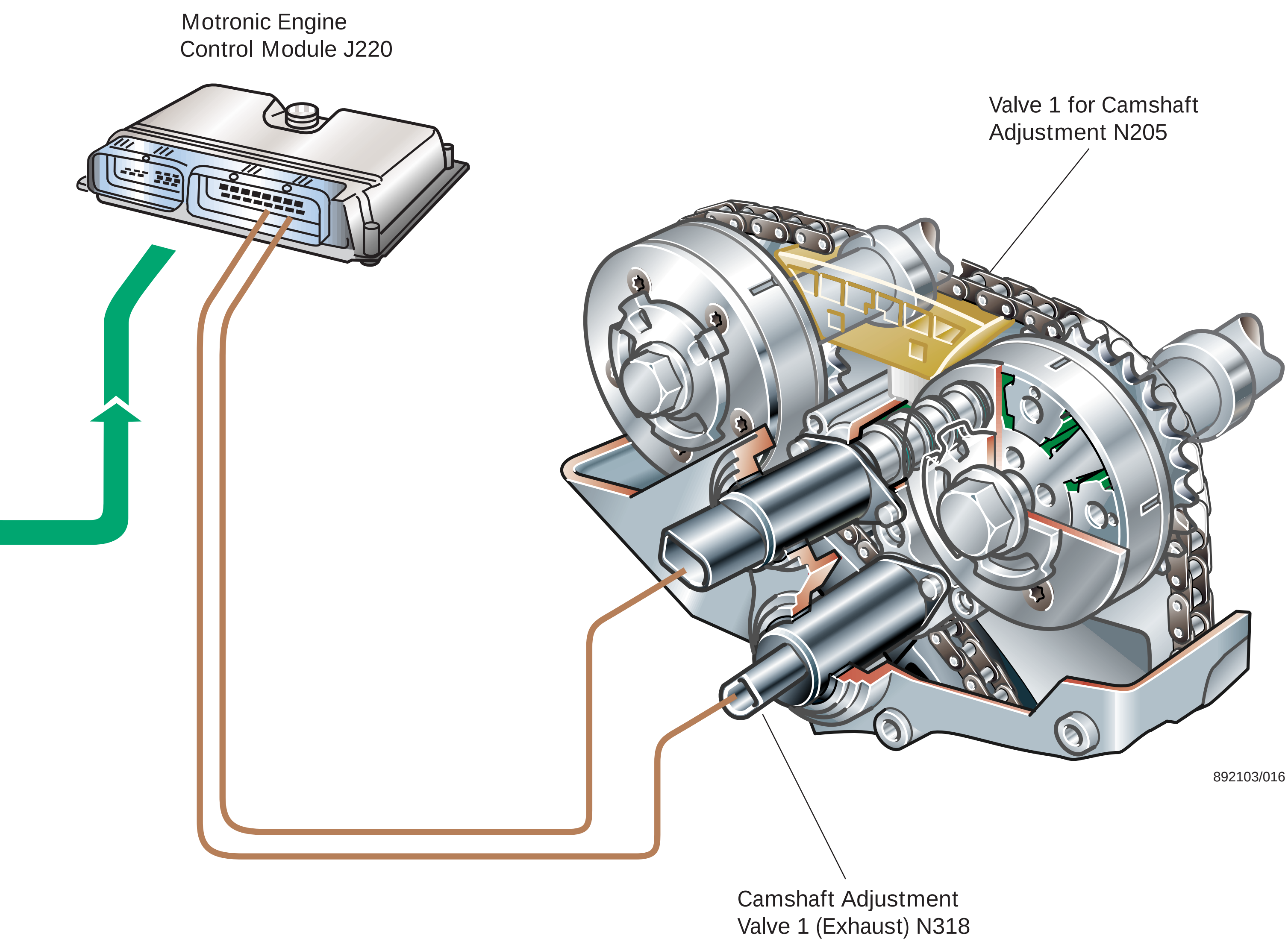
The Motronic Engine Control Module J220 can vary the negative portion of the duty cycle period at any time based on a memorized characteristic map, using the intake air flow signal (from Mass Air Flow (MAF) Sensor G70) and the engine rpm (from Engine Speed (RPM) Sensor G28) as base values.

The engine temperature signal (from Engine Coolant Temperature (ECT) Sensor G62) can cause a variation in the characteristic map. This in turn will cause a variation in the activation of the Valve 1 for Camshaft Adjustment N205 in order to adapt the variable timing system to the engine operating conditions.



The Motronic Engine Control Module J220 uses signals from both Camshaft Position (CMP) Sensor G40 and Camshaft Position (CMP) Sensor 2 G163 as feedback signals to verify the operation of the variable timing.

When a fault is detected in the system, the Motronic Engine Control Module J220 will place both solenoids in the rest position and inform the driver using the Malfunction Indicator Lamp (MIL) K83.



Camshaft Adjustment Valves

The Valve 1 for Camshaft Adjustment N205 and Camshaft Adjustment Valve 1 (Exhaust) N318 are located in the timing cover and are each comprised of a coil, a nucleus and a rod.

The coil gets power from the Motronic Engine Control Module J220 and creates a magnetic field which displaces the nucleus. The nucleus causes the rod to move and open or close the oil passages.

Energizing

The Motronic Engine Control Module J220 energizes each of the solenoids independently.

The Camshaft Adjustment Valve 1 (Exhaust) N318 modifies the passage of oil to the exhaust camshaft adjuster, and is supplied with electrical ground when the engine speed does not exceed 1200 rpm.

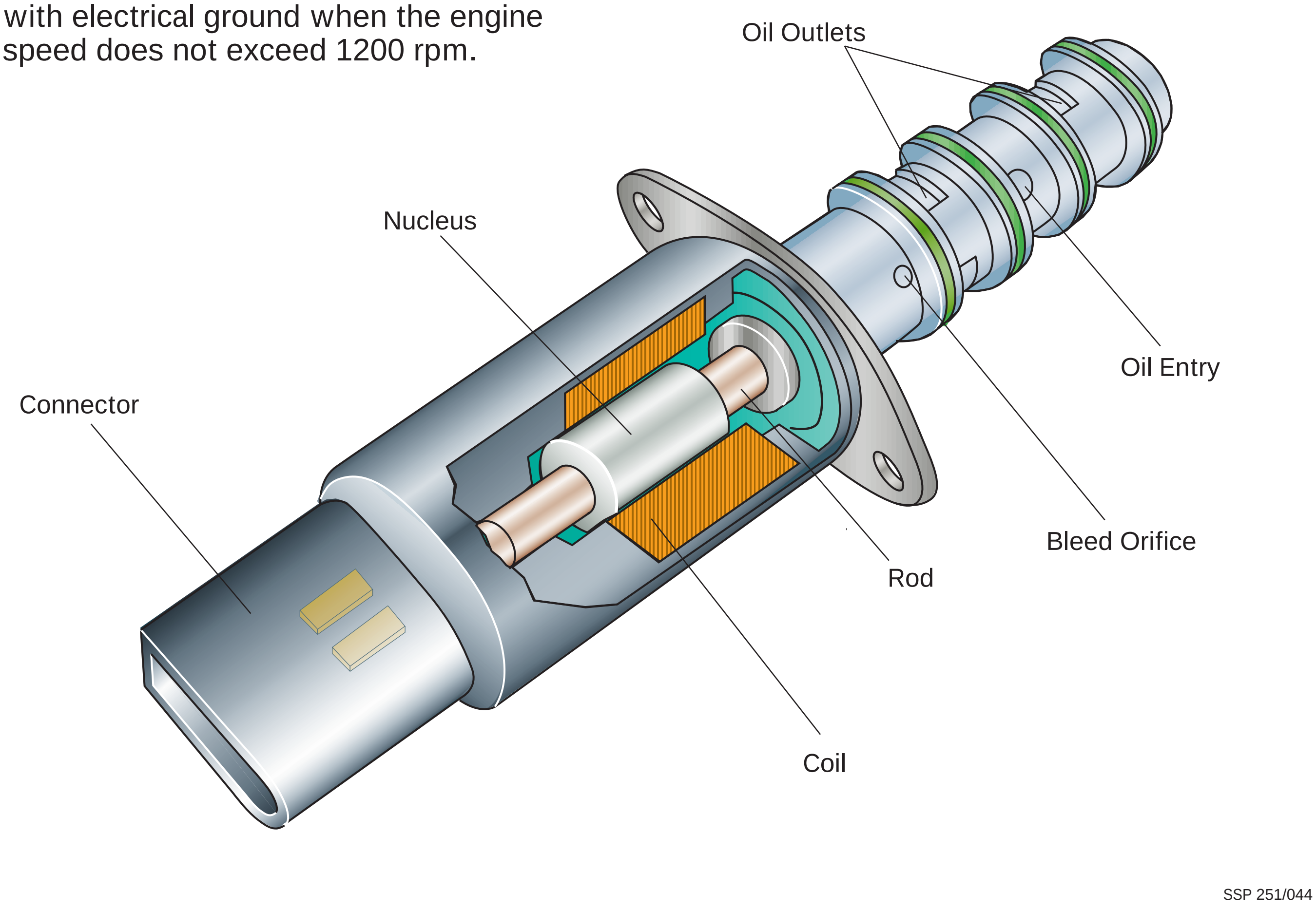
The Valve 1 for Camshaft Adjustment N205 controls the oil passage to the intake camshaft, and is energized with a fixed frequency signal and a variable negative duty cycle.

Substitute Function and Self-Diagnosis

If a fault occurs in either of the solenoids, the Motronic Engine Control Module J220 will deactivate the variable timing and memorize the fault.

This will result in a loss in engine power and an increase in harmful emissions.

This condition will be indicated to the driver since the Malfunction Indicator Lamp (MIL) K83 will remain on permanently.



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Why Variable Valve Timing?

To achieve optimum volumetric efficiency throughout the engine's speed range, the valves must be opened and closed at precise points during the four-stroke Otto cycle. This is necessary to allow adequate time for the filling and scavenging of the cylinders. These points are not static, but change depending on engine speed and load.

The non-adjustable camshafts used in most passenger cars are designed to provide a compromise in valve opening and closing so that the engine can perform satisfactorily at all speeds. This generally results in an engine with a torque output that peaks early and declines gradually as engine speed (rpm) is increased.

Adjustable valve timing systems overcome the limitations of static valve timing by altering the points in the four-stroke cycle when the valves open and close. This allows the 2.8 liter 24 valve engine to produce higher torque throughout a wider rpm range.

During the four-stroke Otto cycle, there are four valve events. They are:

- Intake valve opens (IVO)
- Intake valve closes (IVC)
- Exhaust valve opens (EVO)
- Exhaust valve closes (EVC)

Of the four valve events, the intake valve closing (IVC) point is significant. It is this event that determines the distance into the compression stroke the piston travels before the intake valve closes. This effects the how much air/fuel mixture can enter the cylinder.

The exhaust valve opening (EVO) point is critical in determining how much of the air/fuel charge is burned during the power stroke, and the flow of exhaust from the cylinder. The longer the valve is closed, the longer the air/fuel mixture can burn. If the valve opens too late, energy is wasted pumping the exhaust from the cylinder.

The exhaust valve closing (EVC) point and intake valve opening (IVO) point are not as important as the other valve events when viewed separately. The importance of the EVC and IVO events is that together they determine the valve overlap period. This is the time that both the intake and exhaust valves are open simultaneously. This is a critical factor in scavenging exhaust gases from the cylinder and in controlling emissions.

By using adjustable intake and exhaust camshafts, it is possible to control the timing of the valve events at various engine speeds and loads. This results in strong performance and economical operation, while still meeting stringent emissions requirements.

Intake Camshaft Adjustment

When the engine is started or running at idle, the intake camshaft is adjusted to the retarded position. In this position the IVO occurs at 25° after top-dead-center (TDC). This allows no valve overlap, and results in low emissions and smooth engine running at idle.

At partial load, the intake camshaft is advanced to approximately 25° before TDC. When the intake valve timing is advanced, the IVO occurs earlier, and valve overlap is increased. With increased valve overlap time, the exhaust gases are not all scavenged from the combustion chamber.

This exhaust gas recirculation dilutes the incoming air/fuel charge, lowering combustion pressure and temperature without the need for an external EGR Valve.

Advancing the camshaft also means that the IVC occurs earlier. This is desirable at low engine speeds and partial loads to prevent the piston from pushing the air/fuel charge back into the intake manifold. This effect, known as "reversion," would severely limit low-end torque and raise emissions.

As engine load increases, the velocity of the intake air charge increases, and the IVC must occur later in order to allow the "ram effect" of the intake air to completely fill the cylinder. In addition, as engine speed (rpm) increases, the piston moves faster, and the time for the cylinder to become adequately filled becomes shorter.

Therefore, at high engine speeds and loads, the Motronic Engine Control Module J220 will vary the intake camshaft timing based on a map in the Motronic Engine Control Module J220 which takes into account load, rpm, and intake manifold change-over position.

If the camshaft adjustment fails, the intake camshaft is returned to the default position of 25° after TDC.

Exhaust Camshaft Adjustment

Unlike the intake camshaft, the exhaust valves are only adjusted to close at two points: 25° and 3° before TDC.

Early exhaust valve opening (EVO) may not allow all the power of the combustion process to be used. If the EVO occurs late, all the power of the combustion process is used, but power is wasted by pumping the exhaust gases from the cylinder. The optimum EVO varies with engine speed, and is closely related to the design of the exhaust system.

At engine speeds of less than 1200 rpm, EVC is set at the idling position of 25° before TDC, depending on load. For all other speeds, the EVC is set to 3° before TDC. This achieves good performance characteristics at full load, and a large valve overlap to reduce emissions at partial loading.

If the camshaft adjustment fails, the exhaust camshaft is returned to the default position of 3° before TDC.

Variable Intake Manifold

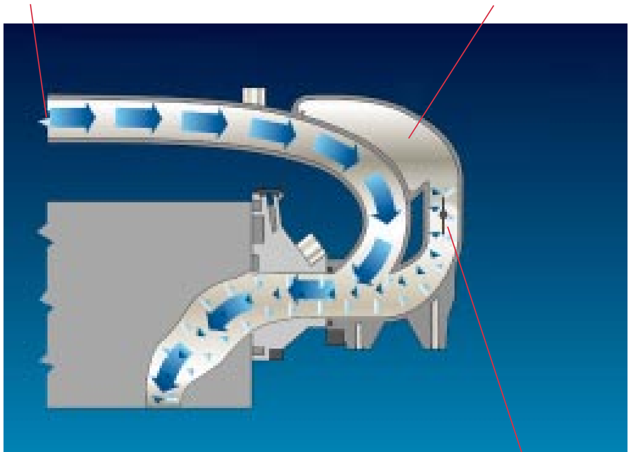
The variable intake manifold already in use on Golf and Jetta models equipped with the VR6 engine is being introduced for the first time on the EuroVan. This design increases low rpm torque and high rpm power by taking advantage of the self-charging or “ram effect” that exists at some engine speeds.

By “tuning” the intake manifold air duct length, engineers can produce this ram effect for a given rpm range. A manifold that has two different lengths of air ducts can produce the ram effect over a broader rpm range.

The VR6 engine uses two lengths of air ducts but not in the same way as the dual path manifolds used on other engines. Instead of using high velocity air flow in a long narrow manifold duct to ram more air into an engine at low rpm and then opening a short, large diameter duct for high rpm, the VR6 engine takes advantage of the pressure wave created by the pressure differential that exists between the combustion chamber and the intake manifold.

All air enters the intake manifold plenum, referred to as the torque port, and is drawn down the long intake ducts to the cylinders. A second plenum called the performance port, which is attached to a set of short manifold ducts, joins the long intake ducts near the cylinder head. A performance port valve, similar in design to a throttle valve, separates the performance port from the short ducts.

Note that the performance port does not have any other passages to the intake manifold other than through the performance port valve. It does not have access to the torque port and does not admit any more air into the cylinders than what is already drawn down the long intake ducts.



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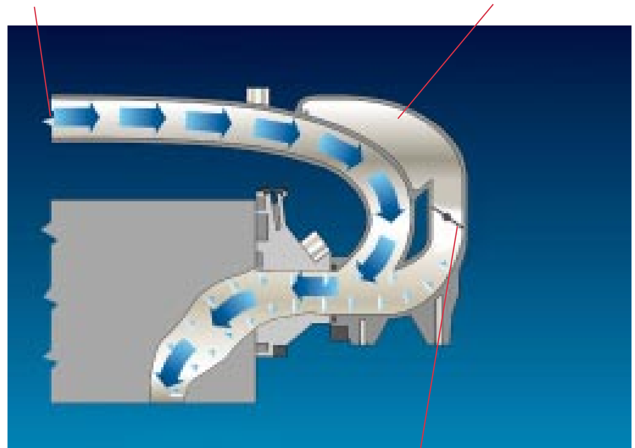

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Performance Port Valve Actuation

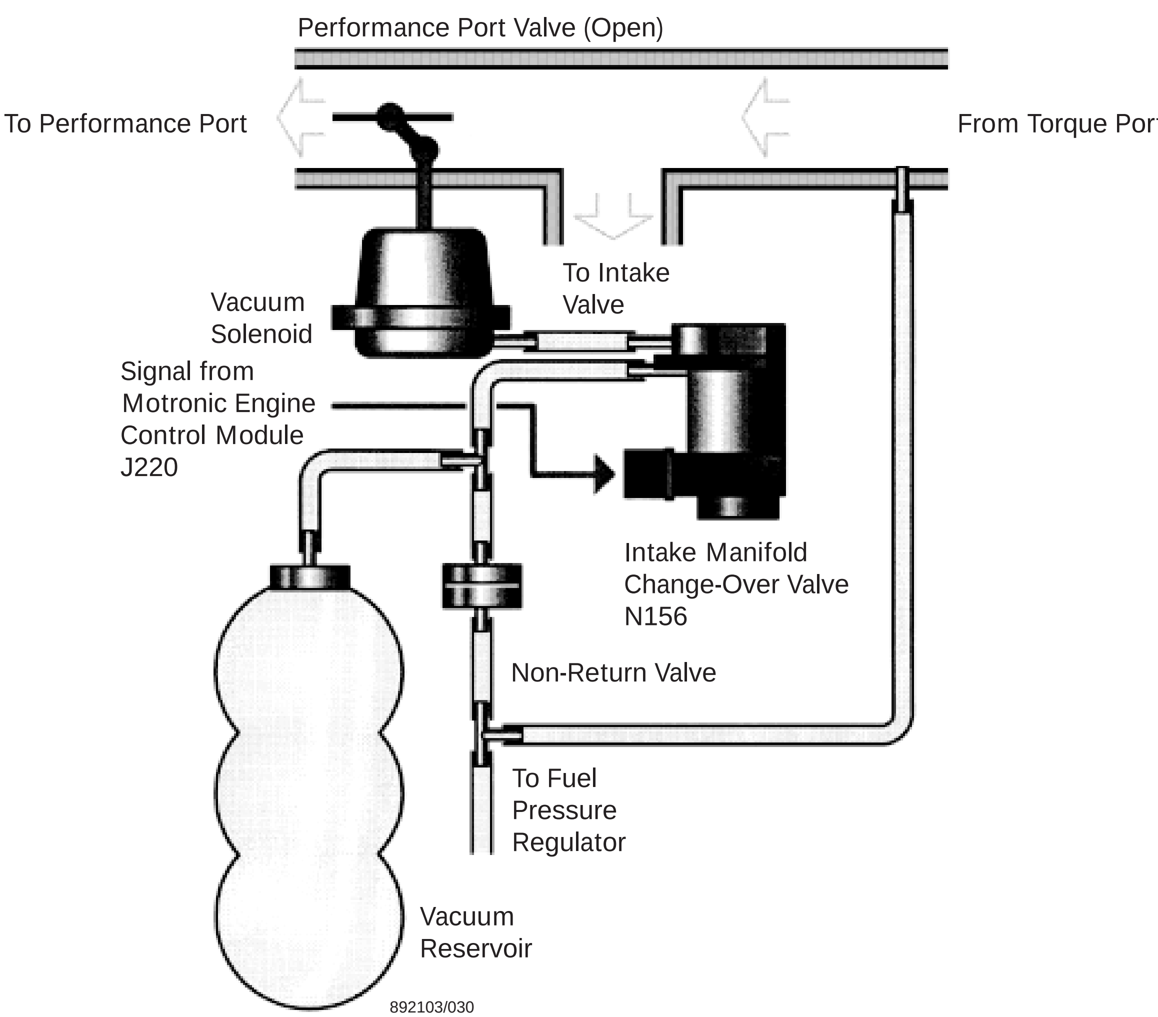
Intake manifold change-over is engine speed dependent. The Motronic Engine Control Module J220 activates the Intake Manifold Change-Over Valve N156, which supplies vacuum to the vacuum solenoid that operates the performance port valve.

A vacuum reservoir and non-return valve is used to store a vacuum supply for the performance valve operation. This is necessary as manifold vacuum may be insufficient to actuate the vacuum solenoid at high engine speeds.

At engine speeds below 900 rpm the performance port is open for idling. The performance port valve is actuated.

At engine speeds between 900 rpm and 4300 rpm the performance port is closed and the engine produces its maximum low end torque. The performance port valve is not actuated.

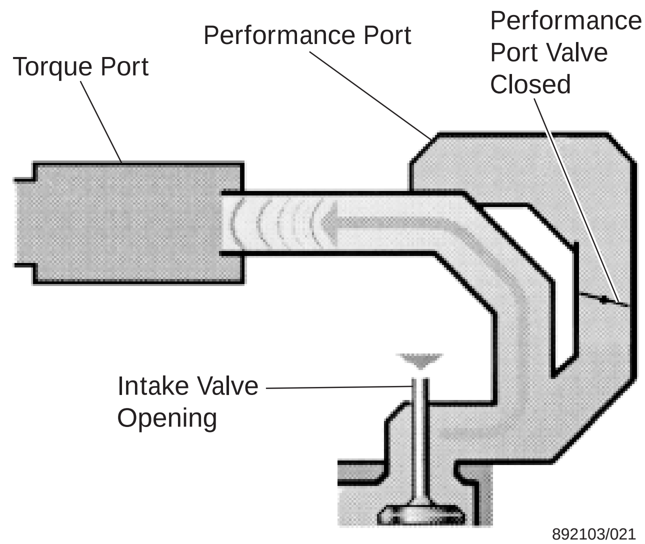
At engine speeds above 4300 rpm the performance port is open. The performance port valve is actuated.



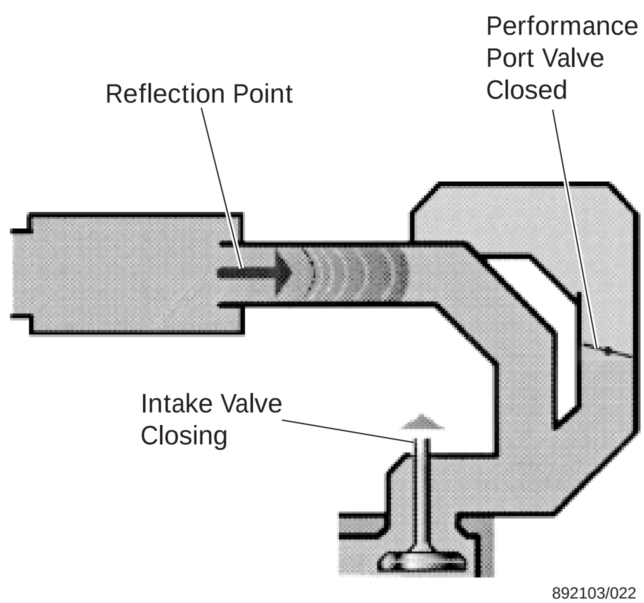
Principles of Variable Intake Manifold Operation

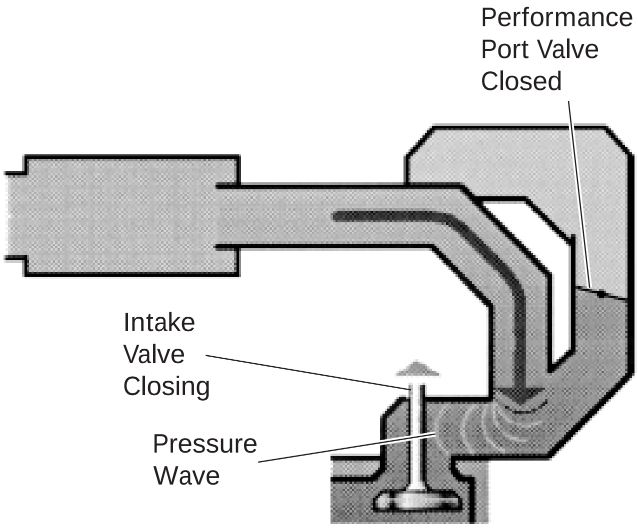
After combustion has taken place in a cylinder, there is a pressure differential between the cylinder combustion chamber and the intake manifold.

When the intake valves open, an intake wave forms in the intake manifold. This low pressure wave moves from the intake valve ports toward the torque port at the speed of sound.



The open end of the intake duct at the torque port has the same effect on the intake wave as a solid wall has on a ball. The wave is reflected back toward the intake valve ports in the form of a high pressure wave.

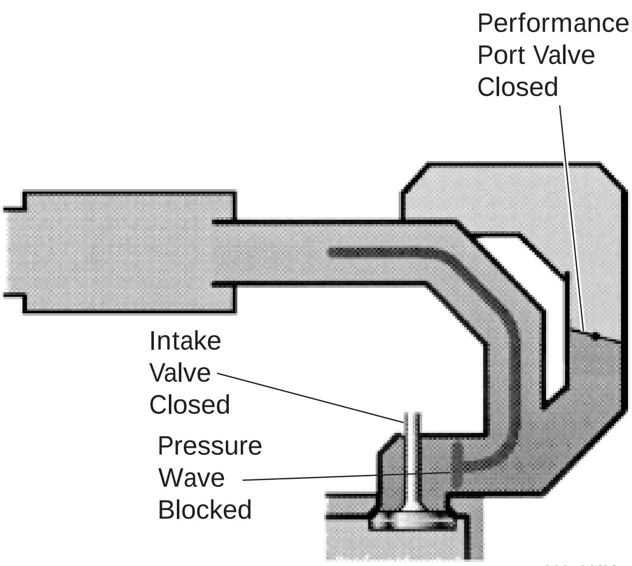




892103/023

At an optimal intake manifold length, the maximum pressure reaches the intake valve ports shortly before the valves close. By this time the piston has started back up the cylinder, compressing the air/fuel mixture.

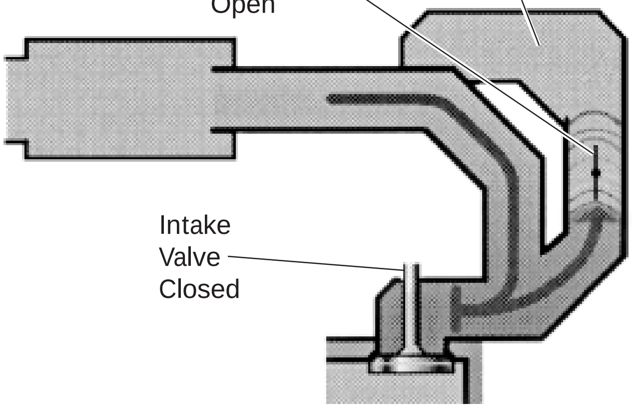
The pressure wave forces more air into the cylinder against this rising compression pressure, filling the cylinder with more air/fuel mixture than would be possible from just the piston moving downward on the intake stroke alone. This adds to what is called the self-charging or “ram effect.”



892103/024

As engine speed increases, the high pressure wave will have less time to reach the inlet port. Because the pressure wave is only able to move at the speed of sound, it will reach the intake valve ports too late. The valves will already be closed, and the self-charging or “ram effect” cannot take place.

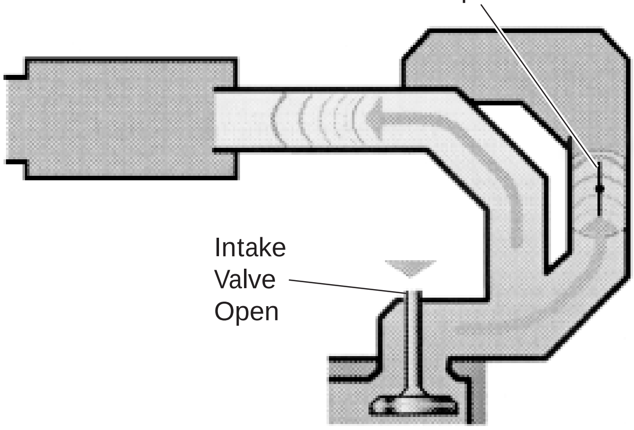
This problem can be solved by “shortening” the intake manifold.



892103/025

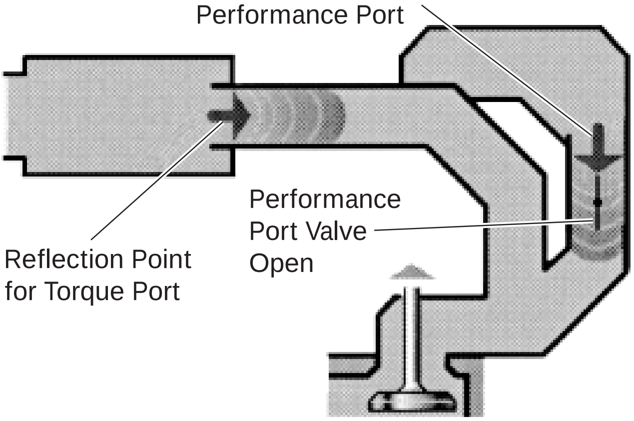
In the VR6 engine, the performance port valve turns to the performance position at engine speeds below 900 rpm and above 4300 rpm. This opens up the path to the performance port. The performance port is designed so that the intake and pressure waves will have a shorter path back to the intake valve ports.

The performance port is filled with air when the intake valve ports are closed.



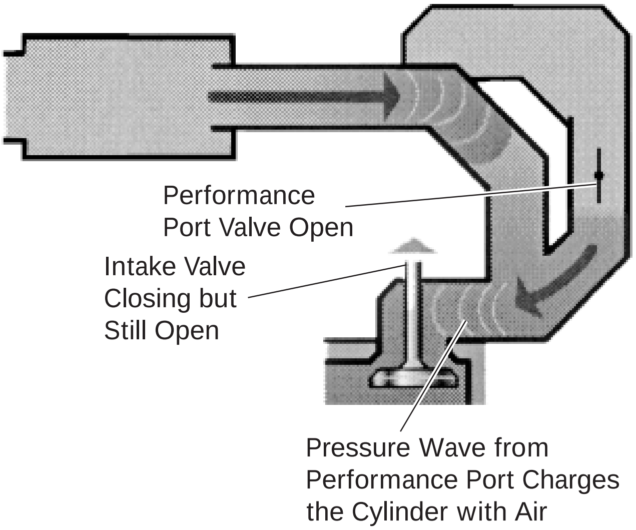
892103/026

When the intake valves open, the intake wave moves up both manifold intake ducts toward the torque port and the performance port at the same speed.



892103/027

Because the distance it must travel is shorter, the intake wave reaches the open end of the intake duct at the performance port before it reaches the open end of the intake duct at the torque port.



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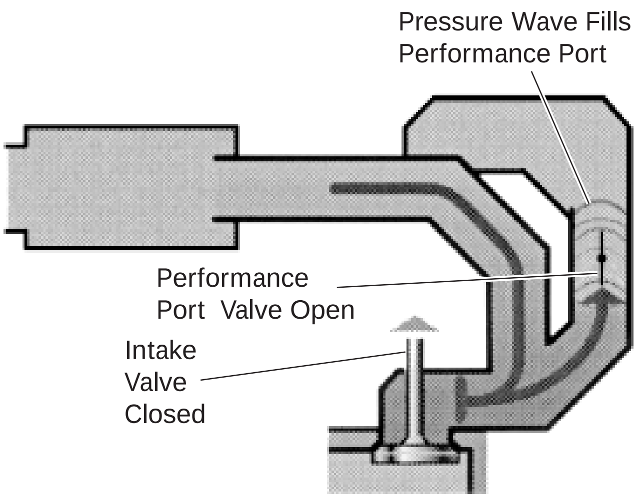
The performance port pressure wave is reflected back toward the intake valve ports, and that air is forced into the combustion chamber before the intake valves close.



892103/029

The pressure wave arriving too late from the torque port is reflected by the closed intake valves and pushes its air charge up the intake duct, filling the performance port in preparation for the next cycle.

The Motronic ME 7 System

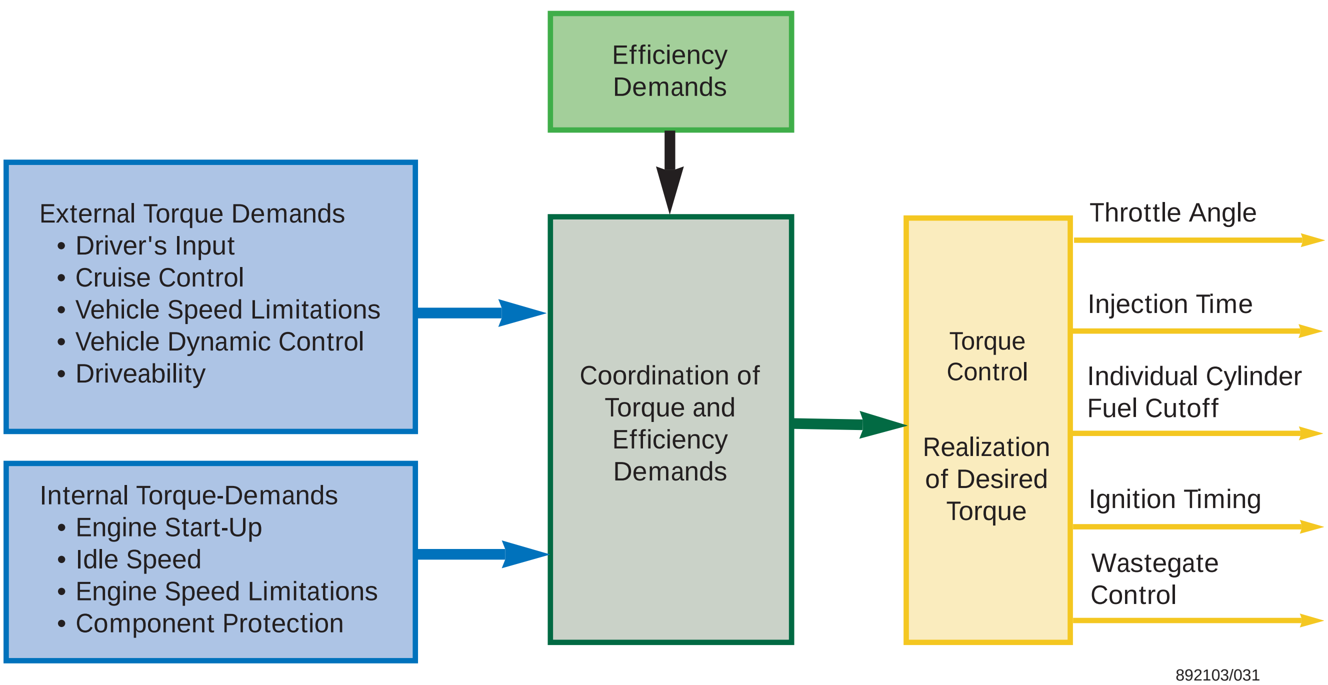
Torque Management

The Motronic ME 7 system processes changes in inputs to control engine torque. Any change in engine torque is interpreted as a torque demand. The ME 7 system is therefore referred to as a “torque-based engine management system.”

Torque demands are any signals that require a change in the torque output of the engine.

Torque demands are converted within the Motronic Engine Control Module J220 into signals which are sent to system actuators, altering injection timing, ignition timing, throttle valve angle, boost control and individual injector cutoff.

These changes affect the regulation of engine torque, affecting performance, efficiency, traction, and vehicle dynamic control.



ME 7 Architecture

Torque Demands/Requests

The Motronic ME 7 system designates functions via torque demands.

Torque demands can originate from external sources, or internally within the Motronic Engine Control Module J220. These may include:

- Driver input
- Cruise control
- A/C demands
- ABS/ASR/ESP
- Transmission Dynamic Shift Program (DSP)

The Motronic ME 7 system takes into account additional torque demands from other external sources, such as:

- Automatic transmission/transaxle
- Air conditioning
- Power steering

Effects of Torque Demands on Engine Torque

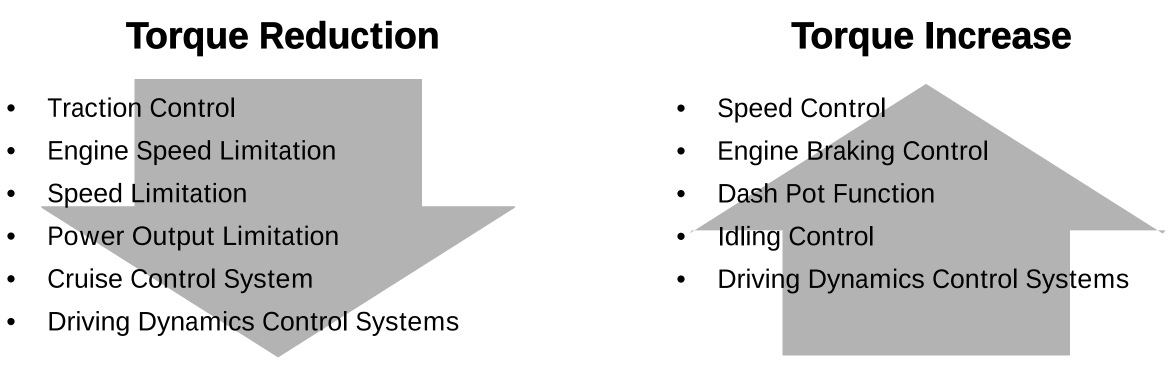
The Motronic Engine Control Module J220 constantly regulates engine torque. It uses signals from multiple components to continually modify system actuators for the desired engine torque.

Example:

The Motronic ECM sees that the idle speed is less than or greater than the specified RPM. The ECM will interpret this as a torque demand.

The Motronic ECM is able to adjust the idle speed either through the charge air path by opening or closing the throttle valve, or through the crankshaft synchronous path by advancing or retarding the ignition timing.

This allows for stable running characteristics under continually varying load conditions.



892103/032

Pathways

In order to meet the torque demands as efficiently as possible, demands for torque are separated into two paths:

- The cylinder charge air path controls all charge influencing components, such as throttle valve angle and wastegate actuation.
- The crankshaft synchronous path controls all interactions that occur simultaneously with the operating cycle of the engine, such as ignition and injection timing.

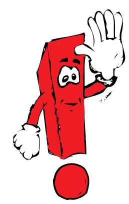
Cylinder Charge Air Path

The air mass necessary to develop a specific torque is made available via the cylinder charge air path. This may include throttle angle or boost pressure on a turbocharged application.

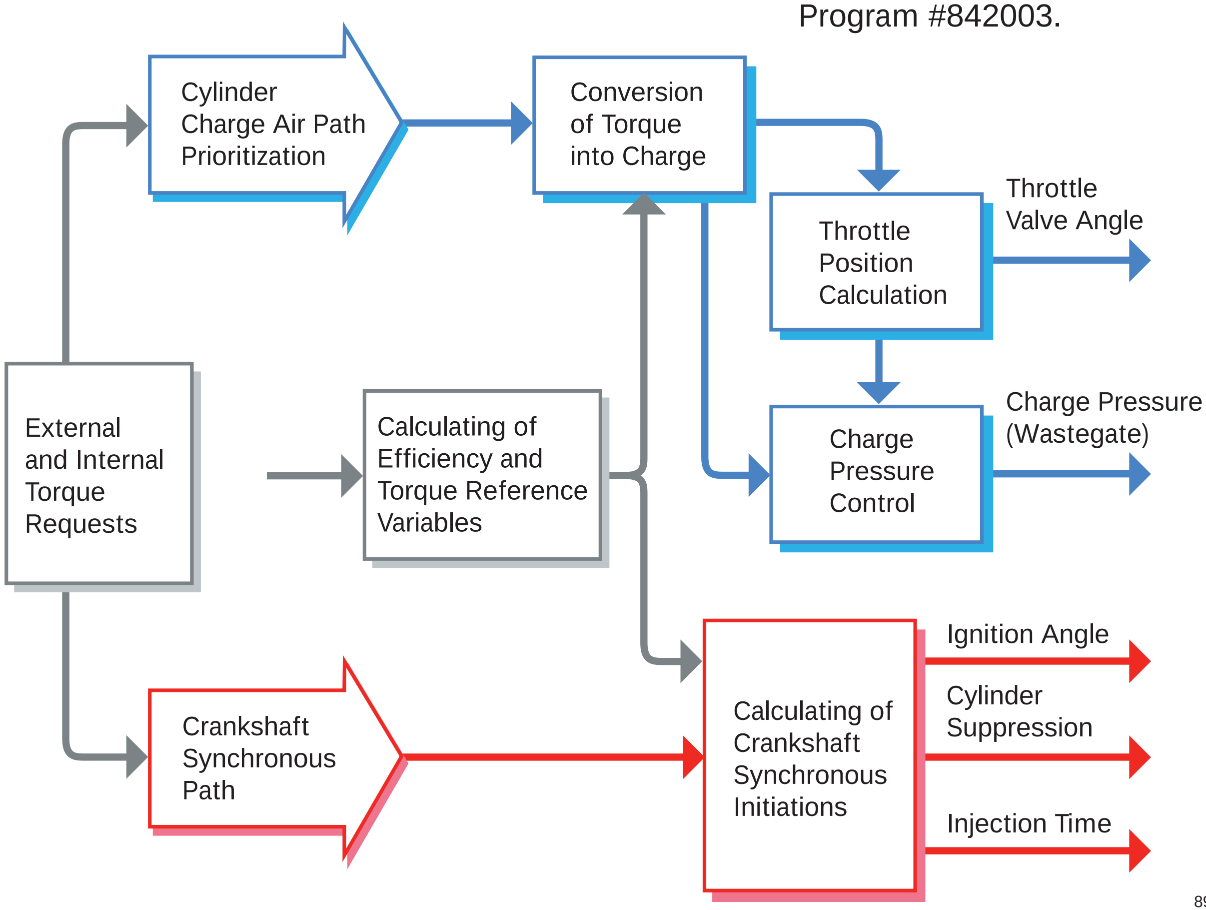
Along this path, long-term torque demands are fulfilled.

Crankshaft Synchronous Path

The crankshaft synchronous path coordinates injector timing and pulse width, as well as cylinder-selective ignition timing. This path is particularly well suited to meeting short-term torque demands, usually having a torque reduction effect.



For more information on Motronic ME 7 and the electronic throttle control, see the Motronic ME 7 Engine Management System Self-Study Program #842003.



892103/033

Engine Management

Assumed Functions

Fuel Injection

— Control of Injected Volume According to a Characteristic Map.
— Sequential Injection.
— Quick Start Synchronization.
— Deceleration Cutoff.
— Maximum Speed Limitation.

Ignition

— Control of Ignition Advance Angle According to a Characteristic Map.
— Selective Cylinder Knock Control.

EVAP System

— Control of Fuel Tank Emissions.
— Correction by Using Lambda Adjustment (Auto-Adaptive Subsystem).

Idle Stabilization

— Adjustment of Idling with the Aid of a Characteristic Map (Auto-Adaptive Subsystem).
— Throttle Shutdown Dampening.
— Digital Idle Stabilization.

Variable Inlet Manifold

— Control of Variable Inlet Manifold.

OBD II

— Warning Light Control.
— Lambda Adjustment Control.
— Catalyzer Monitoring.
— EVAP Circuit Monitoring.
— Secondary Air Injection System Monitoring.
— Combustion Monitoring.

Variable Timing

— Adjustment of Variable Timing System.

Self Diagnosis

— Interrogating Fault Memory.
— Basic Setting.
— Final Control Diagnostics.
— Measurement Value Emission.
— Adaptation of the Electronic Immobilizer.
— Clearance Code.

System Overview

Sensors

Mass Air Flow (MAF) Sensor G70
Intake Air Temperature (IAT) Sensor G42

Engine Speed (RPM) Sensor G28

Camshaft Position (CMP) Sensor G40

Camshaft Position (CMP) Sensor 2 G163

Angle Sensor 1 for Throttle Drive G187 and Angle Sensor 2 for Throttle Drive G188

Knock Sensor (KS) 1 G61 and Knock Sensor (KS) 2 G66

Heated Oxygen Sensor (HO2S) G39

Oxygen Sensor (O2S) Behind Three Way Catalytic Converter G130

Engine Coolant Temperature (ECT) Sensor G62

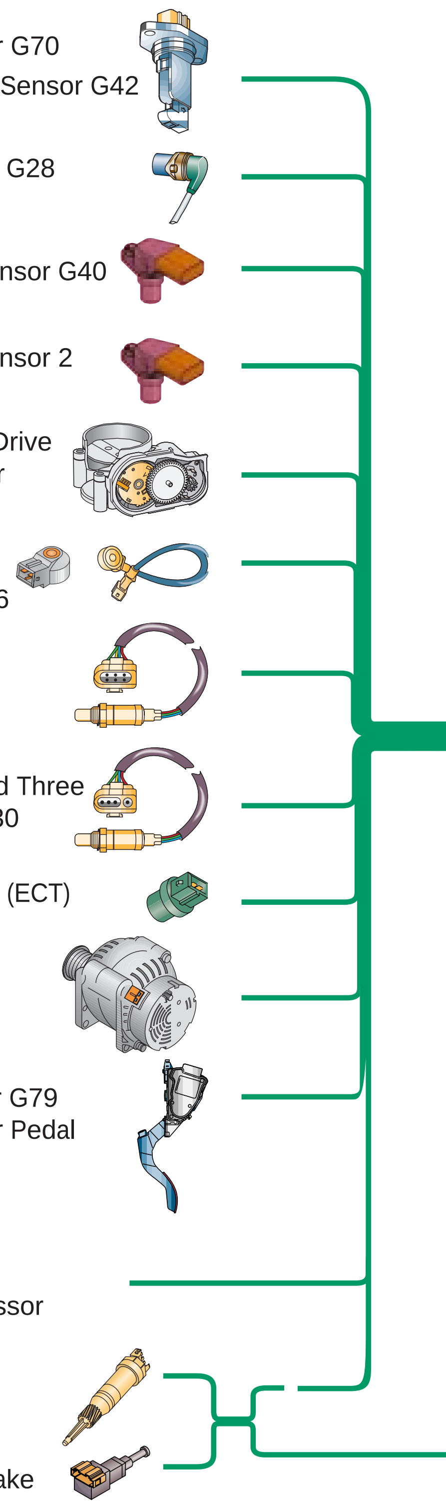
Generator C (+ Terminal/DF)

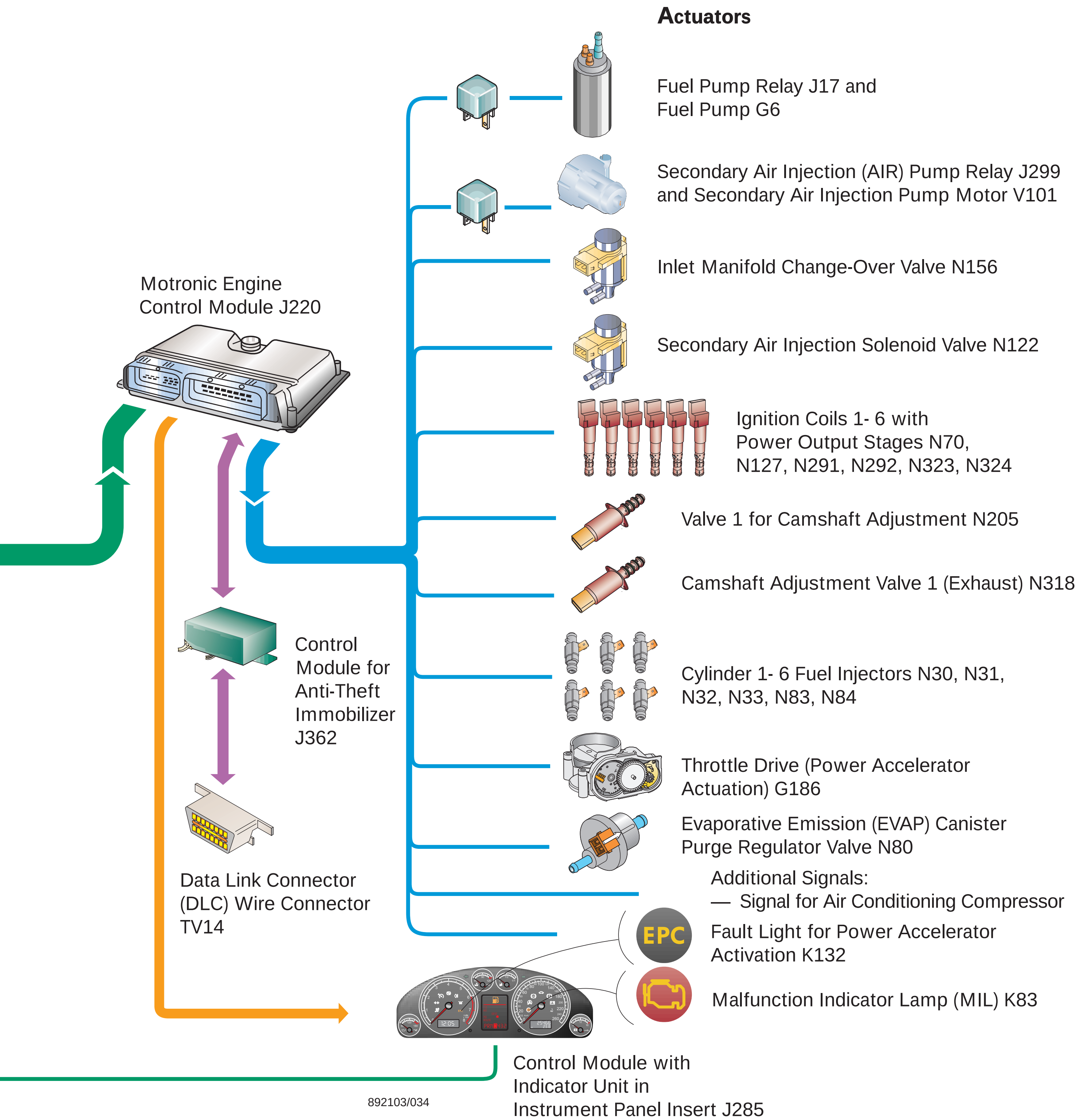
Throttle Position (TP) Sensor G79 and Sender 2 for Accelerator Pedal Position G185

Additional Signals:
— Air Conditioning On
— Air Conditioning Compressor
— Cruise Control

Speedometer Vehicle Speed Sensor (VSS) G22

Brake Light Switch F and Brake Pedal Switch F47




Actuators
Fuel Pump Relay J17 and
Fuel Pump G6
Secondary Air Injection (AIR) Pump Relay J299
and Secondary Air Injection Pump Motor V101
Inlet Manifold Change-Over Valve N156
Secondary Air Injection Solenoid Valve N122
Ignition Coils 1- 6 with
Power Output Stages N70,
N127, N291, N292, N323, N324
Valve 1 for Camshaft Adjustment N205
Camshaft Adjustment Valve 1 (Exhaust) N318
Cylinder 1- 6 Fuel Injectors N30, N31,
N32, N33, N83, N84
Throttle Drive (Power Accelerator
Actuation) G186
Evaporative Emission (EVAP) Canister
Purge Regulator Valve N80
Additional Signals:
— Signal for Air Conditioning Compressor
EPC
Fault Light for Power Accelerator
Activation K132
Malfunction Indicator Lamp (MIL) K83
Motronic Engine
Control Module J220
Control
Module for
Anti-Theft
Immobilizer
J362
Data Link Connector
(DLC) Wire Connector
TV14
Control Module with
Indicator Unit in
Instrument Panel Insert J285
892103/034

Camshaft Position (CMP) Sensor G40 and Camshaft Position (CMP) Sensor 2 G163

Both sensors work using the Hall Principle and are located in the upper timing cover. They take their readings from the two reluctors which rotate together with the camshafts.

Signal Application

The Camshaft Position (CMP) Sensor G40 signal is used by the Motronic Engine Control Module J220 together with the signal from the Engine Speed (RPM) Sensor G28 to synchronize the injection.

At the same time, a comparison between the signals from Camshaft Position (CMP) Sensor G40, Camshaft Position (CMP) Sensor 2 G163, and Engine Speed (RPM) Sensor G28 is used to monitor operation and adjust the variable timing.

Replacement Function

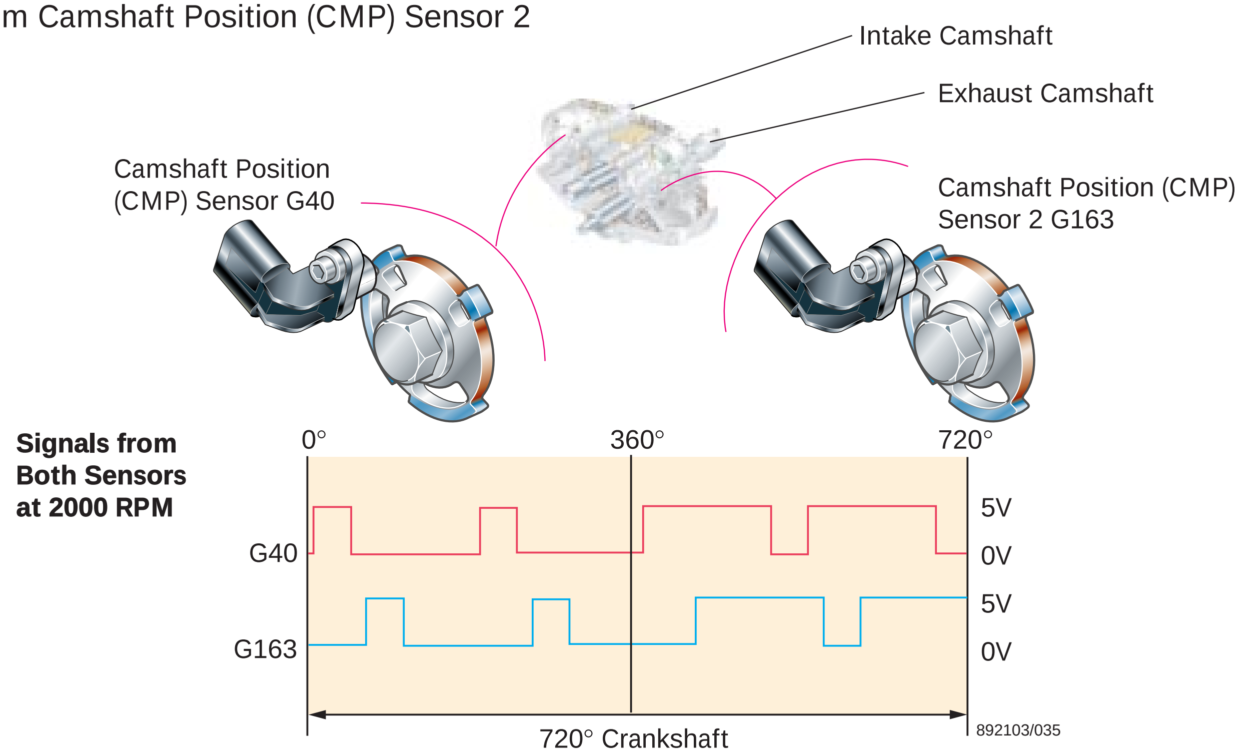
If the signal from the Camshaft Position (CMP) Sensor G40 is missing, the signal from Camshaft Position (CMP) Sensor 2 G163 will be used as a reference value for injection synchronization.

If both signals should fail while the engine is running, the engine will continue to run and can be re-started. The Motronic Engine Control Module J220 uses a function called “start-up recognition” for this purpose.

When the fault occurs, the Motronic Engine Control Module J220 will set fuel injection and ignition timing based on the Engine Speed (RPM) Sensor G28 signal. Ignition timing will be retarded 15 degrees as a safety precaution.

If either Camshaft Position (CMP) Sensor G40 or Camshaft Position (CMP) Sensor 2 G163 fails, the Motronic Engine Control Module J220 will deactivate the variable valve timing function. Both camshafts will be set to their initial start-up positions.

A failure of either sensor will activate the Malfunction Indicator Lamp (MIL) K83 the second time the vehicle is started after the fault occurs.



Ignition Coils 1 – 6 with Power Output Stages (N70, N127, N291, N292, N323, and N324)

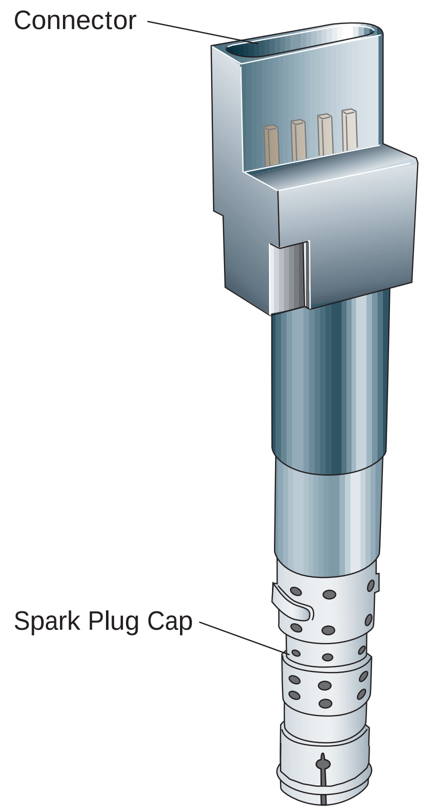
The ignition system comprises six ignition coils with a “coil on plug” configuration. This eliminates the need for spark plug cables.

Energizing

Each ignition coil gets positive voltage from ignition terminal 15 and is grounded for operation. The Motronic Engine Control Module J220 sends a signal to energize the ignition coil. The break in this signal generates the spark.

Replacement Function

If any of the ignition coils are faulty, the corresponding cylinder will not be able to complete combustion. This condition is picked up by the Motronic Engine Control Module J220, and it will cut off the injection to this cylinder and at the same time switch on the Malfunction Indicator Lamp (MIL) K83.



Electronic Stabilization Program

Introduction

The electronic stabilization program (ESP) is one of the vehicle's active safety features.

It is also known as a "driving dynamic control system."

Expressed in simple terms, ESP is an anti-skid system. It recognizes when the vehicle is in danger of skidding and compensates when the vehicle breaks traction.

Advantages of ESP:

- ESP is not an independent system. In fact it is based on other traction control systems. That is why it also includes the performance features of these systems.
- It relieves the burden on the driver.
- The vehicle remains manageable.
- It reduces the accident risk if the driver overreacts.

Glossary

ABS

Antilock **B**raking **S**ystem

This system prevents the wheels from locking while braking. Despite the system's powerful braking effect, track stability and steerability are retained.

ASR

Anti **S**lip **R**egulation

This system prevents the driven wheels from spinning, such as on ice or gravel, by intervening with the engine management system to reduce engine torque.

EBD

Electronic **B**rake Pressure **D**istribution

This system prevents overbraking of the rear wheels before ABS takes effect or if ABS is unavailable, due to specific fault states.

EDL

Electronic **D**ifferential **L**ock

This system makes it possible to drive away on road surfaces where each wheel has a different degree of traction by braking the wheel which is spinning.

ESP

Electronic **S**tabilization **P**rogram

This system prevents the vehicle from skidding by selectively intervening in the brake and engine management systems. The following abbreviations are also used for this type of anti-skid system:

- **ASMS** (**A**utomatic **S**tability **M**anagement **S**ystem),
- **DSC** (**D**ynamic **S**tabilization **C**ontrol),
- **DDC** (**D**riving **D**ynamic **C**ontrol),
- **VSA** (**V**ehicle **S**tabilization **A**ssist) and
- **VSC** (**V**ehicle **S**tabilization **C**ontrol).

EBC

Engine **B**raking **C**ontrol

This system prevents the driven wheels from locking due to the engine braking effect when the accelerator pedal is released suddenly or when the vehicle is braked with a gear engaged.

Control Process

Before ESP can respond to a critical driving situation, it must answer two questions:

A — In what direction is the driver steering?

B — In what direction is the vehicle moving?

The system obtains the answer to the first question from the steering angle sensor (1) and the speed sensors at the wheels (2).

The answer to the second question is supplied by measuring the yaw rate (3) and lateral acceleration (4).

If the information received provides different answers to questions A and B, ESP assumes that a critical situation can occur and that intervention is necessary.

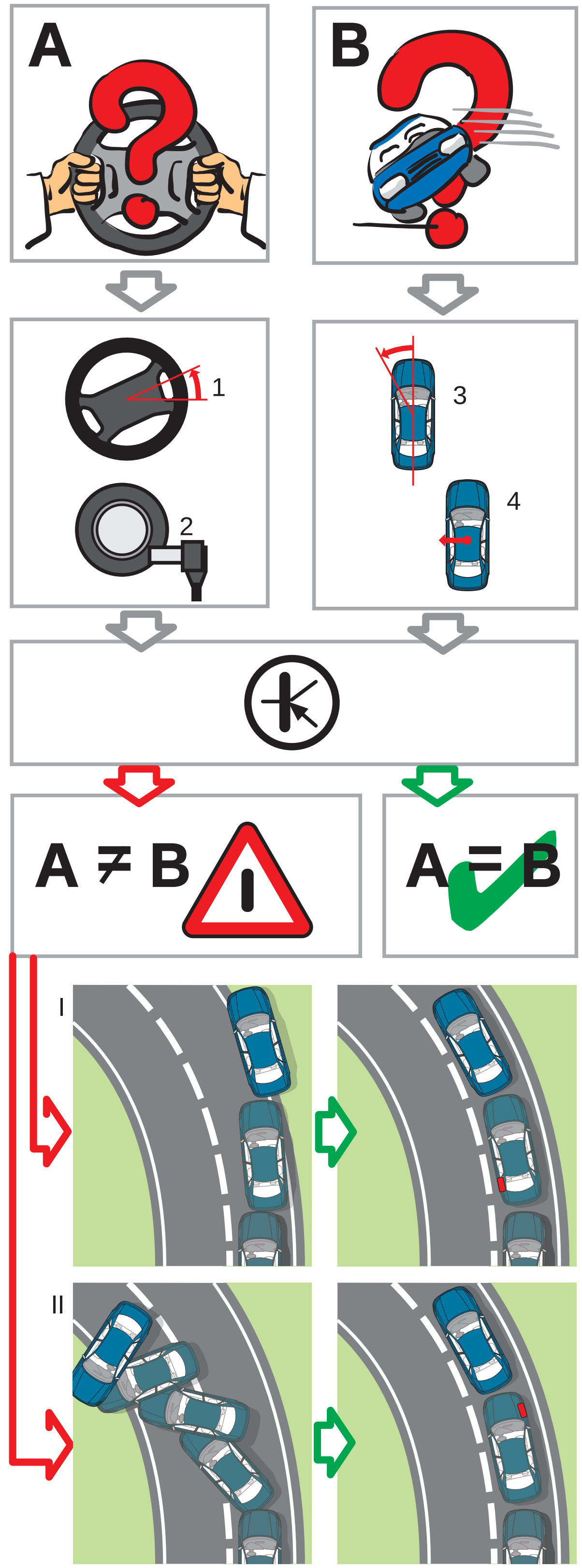
A critical situation can result in two different types of behavior of the vehicle:

I. The vehicle threatens to understeer.

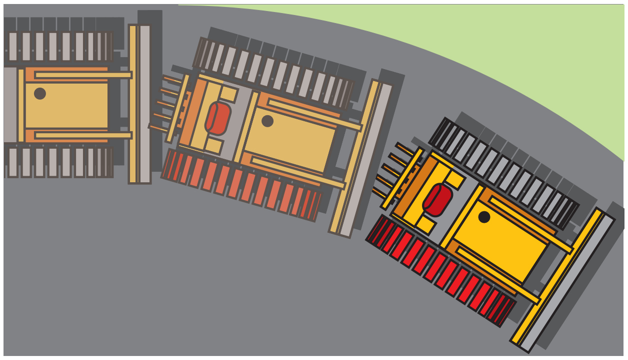
By selectively activating the rear brake on the inside of the corner and intervening in the engine and transmission management systems, ESP prevents the vehicle from overshooting the corner.

II. The vehicle threatens to oversteer.

By selectively activating the front brake on the outside of the corner and intervening in the engine and transmission management systems, ESP prevents the vehicle from skidding.



SSP 204/008

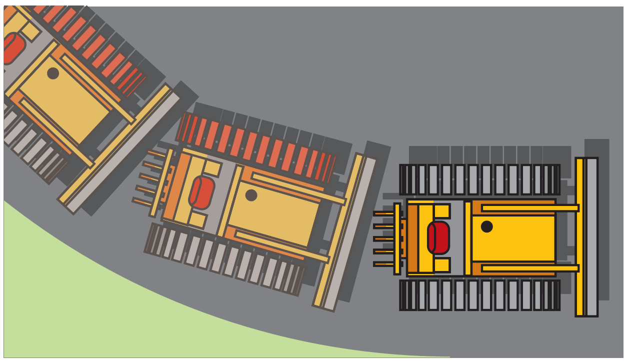


892103/038

As you can see, ESP can counteract both oversteer and understeer.

To achieve this, it is necessary to initiate a change of direction without direct intervention in the steering system.

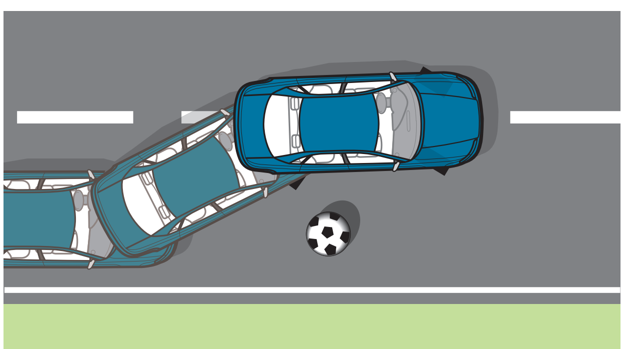
The basic principle applied is the same as that used for tracked vehicles. When a bulldozer wants to negotiate a left-hand bend, the track on the inside of the corner is braked and the outer track is accelerated.



892103/039

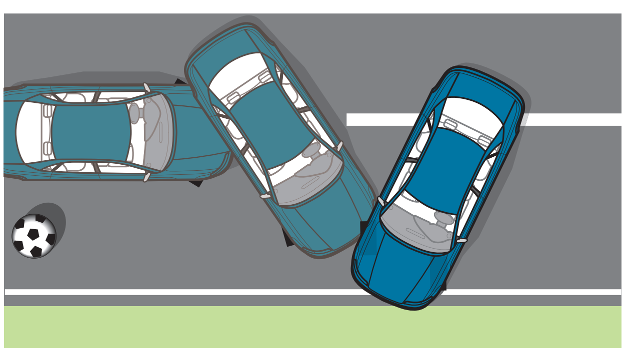
To make a right-hand turn and return to the original direction of travel, the track which was previously on the inside of the corner and now on the outside of the corner is accelerated and the other track is braked.

ESP intervenes along much the same lines. Here is an example of how a sudden maneuver is handled by a vehicle **without ESP.**



892103/040

The vehicle must avoid an obstacle which suddenly appears. At first, the driver steers very quickly to the left and to then immediately to the right.



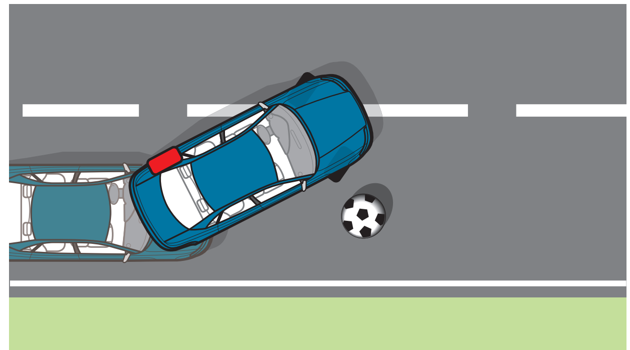
892103/041

The vehicle swerves due to the driver's steering wheel movements and the rear end breaks away. The driver is no longer able to control the resulting rotation of the vehicle around its vertical axis.

Now let us observe how a vehicle **with ESP** handles the same situation.

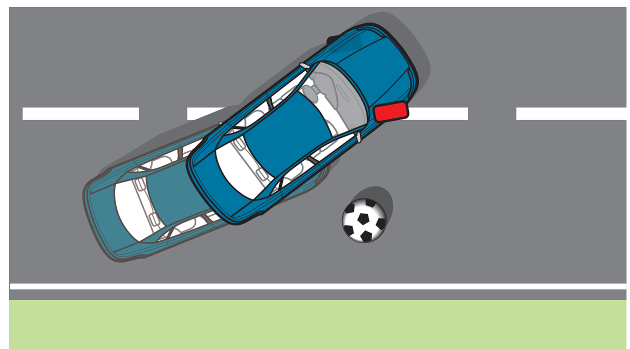
The vehicle attempts to avoid the obstacle. From the data provided by the sensors, ESP recognizes that the vehicle is losing stability.

The system calculates its counteraction measures: ESP brakes the left-hand rear wheel. This promotes the turning motion of the vehicle. The lateral forces acting on the front wheels are equalized.



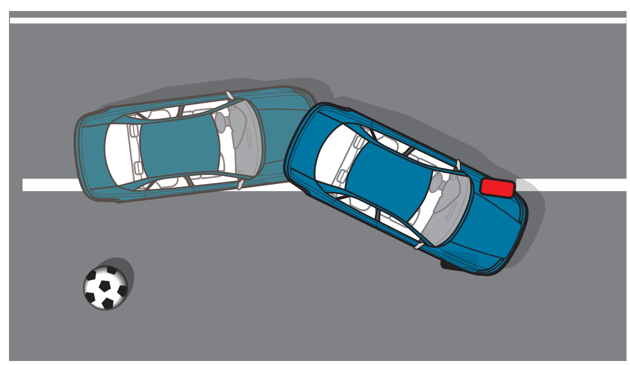
892103/042

As the vehicle swerves to the left, the driver steers to the right. To help the driver steer into the oversteer, the front right wheel is braked. The rear wheels roll freely in order to ensure an optimal buildup of lateral forces acting on the rear axle.



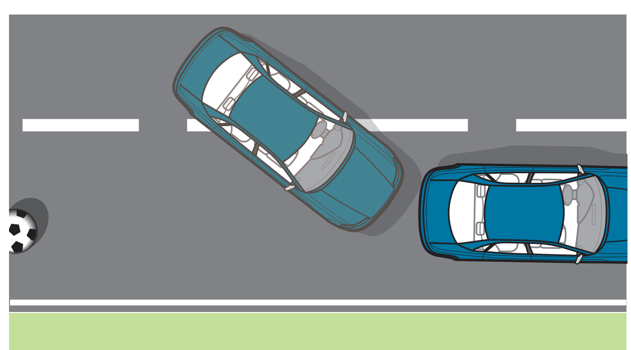
892103/043

The preceding lane change can cause the vehicle to rotate about its vertical axis. To prevent the rear end from breaking away, the front left wheel is braked. In highly critical situations, the wheel may be braked very heavily in order to limit the buildup of lateral forces on the front axle.



892103/044

Once all unstable operating states have been corrected, ESP ends its corrective intervention.



892103/045

The System and Its Components

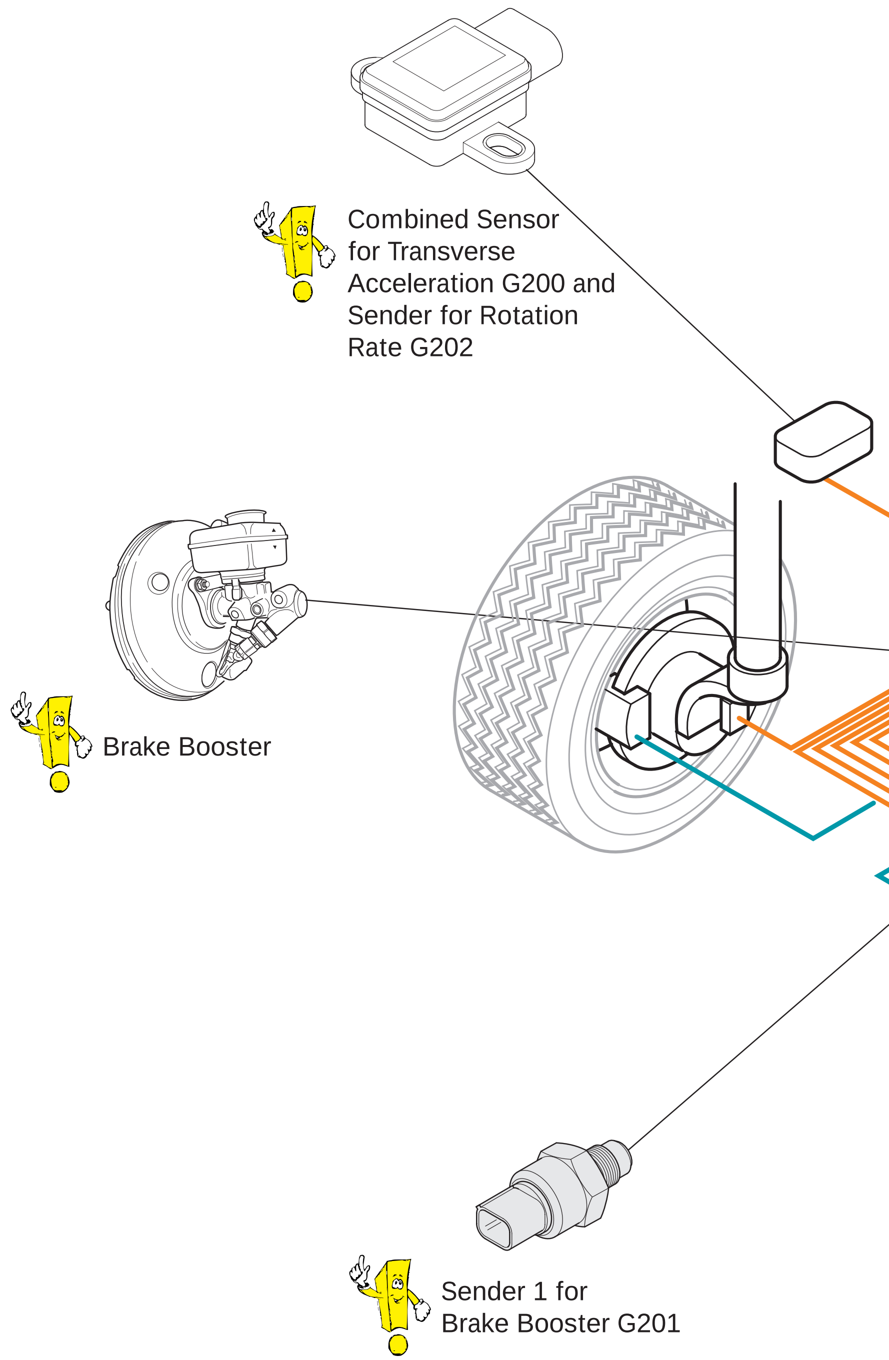
As mentioned already, the electronic stabilization program is based on the proven traction control system.

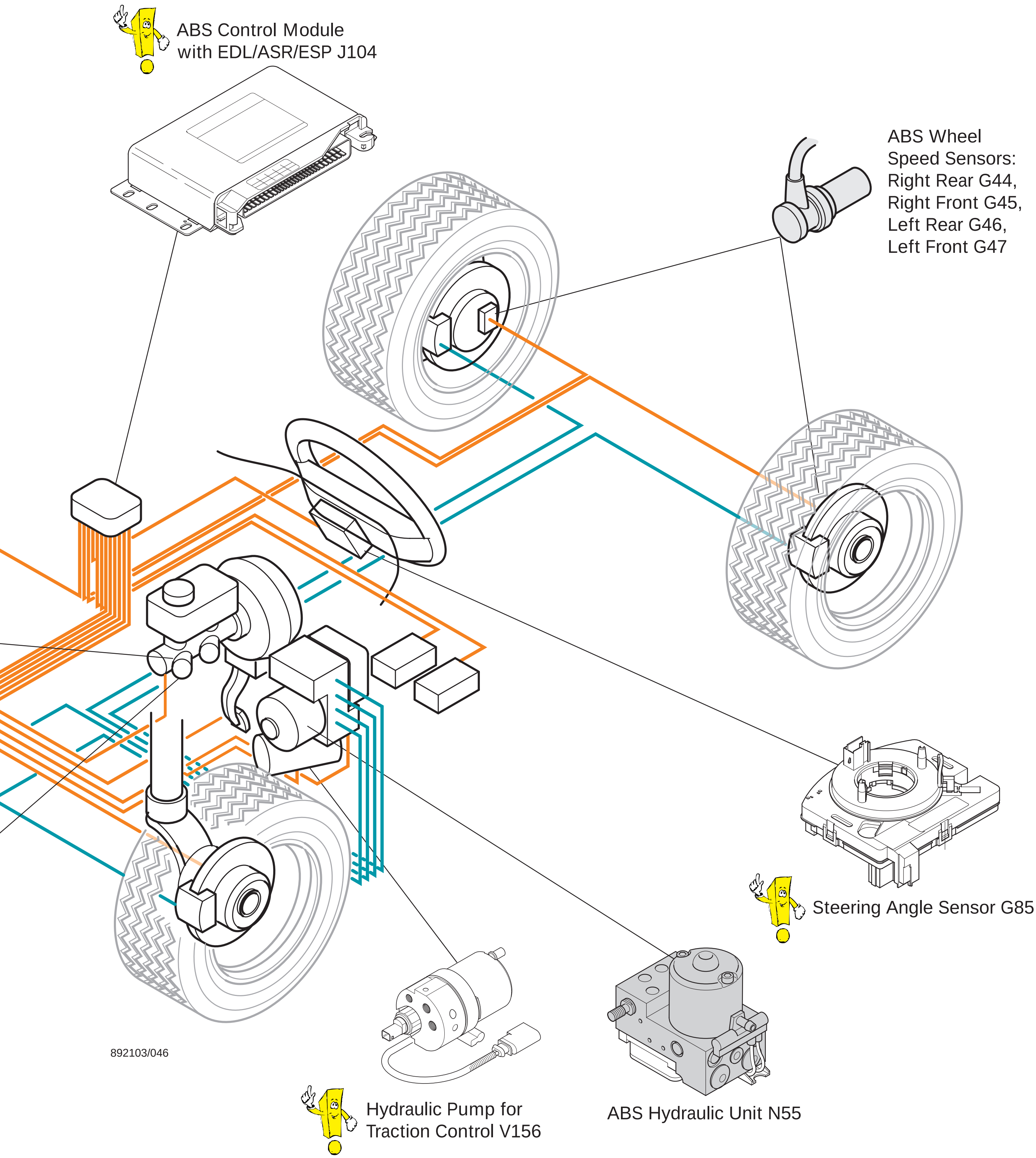
However, it has one key additional feature:

- The system can recognize and compensate for unstable vehicle operating states such as skidding at an early stage.

To achieve this, several additional components are required.

Before we explain ESP in greater detail, here is an overview of these components.




ABS Control Module
with EDL/ASR/ESP J104
ABS Wheel
Speed Sensors:
Right Rear G44,
Right Front G45,
Left Rear G46,
Left Front G47
Steering Angle Sensor G85
892103/046
Hydraulic Pump for
Traction Control V156
ABS Hydraulic Unit N55

System Overview

Sensors

Button for ASR/ESP E256

Brake Light Switch F

Brake Pedal Switch F47

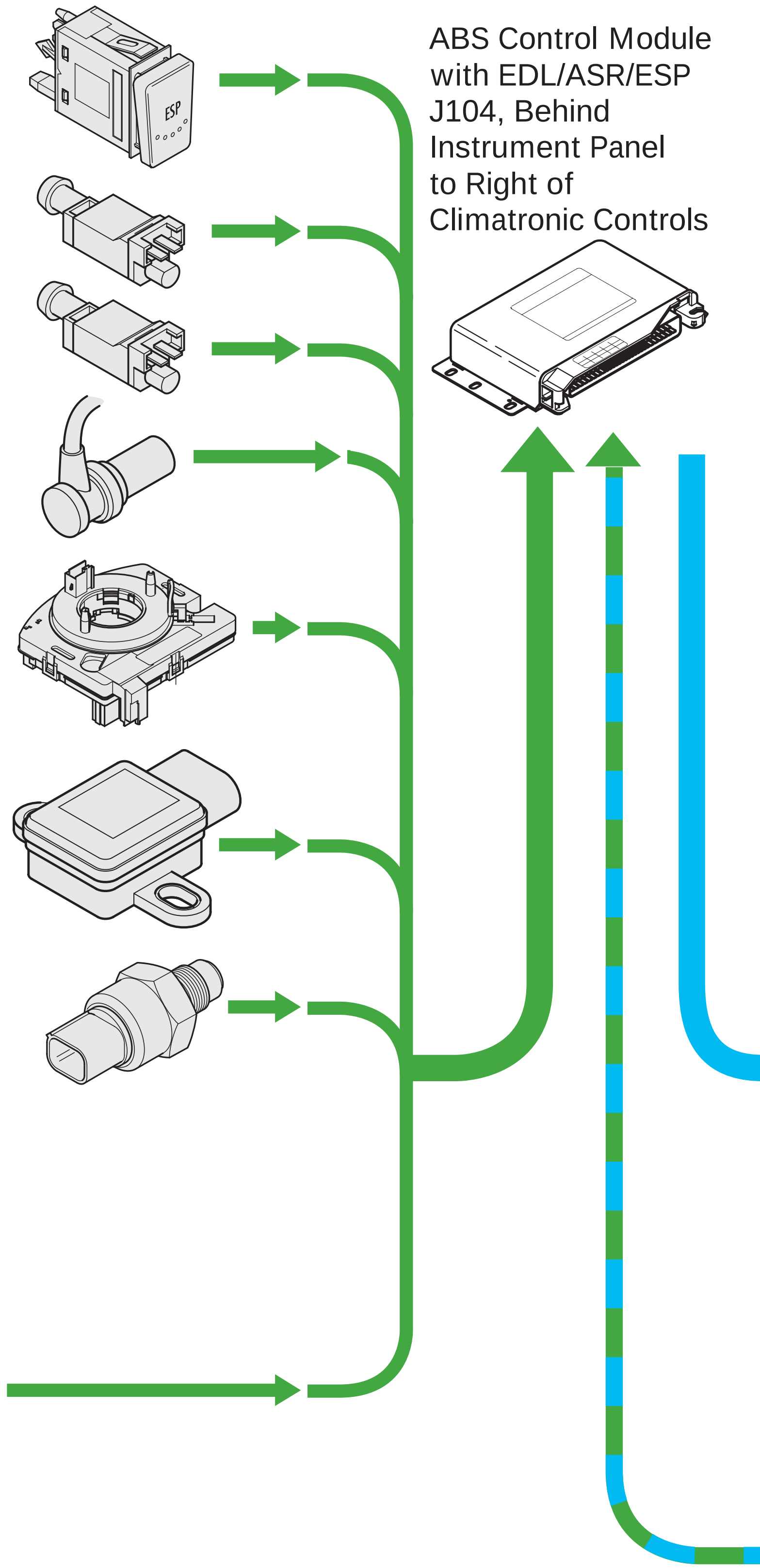
ABS Wheel Speed Sensors:
Right Rear G44,
Right Front G45,
Left Rear G46,
Left Front G47

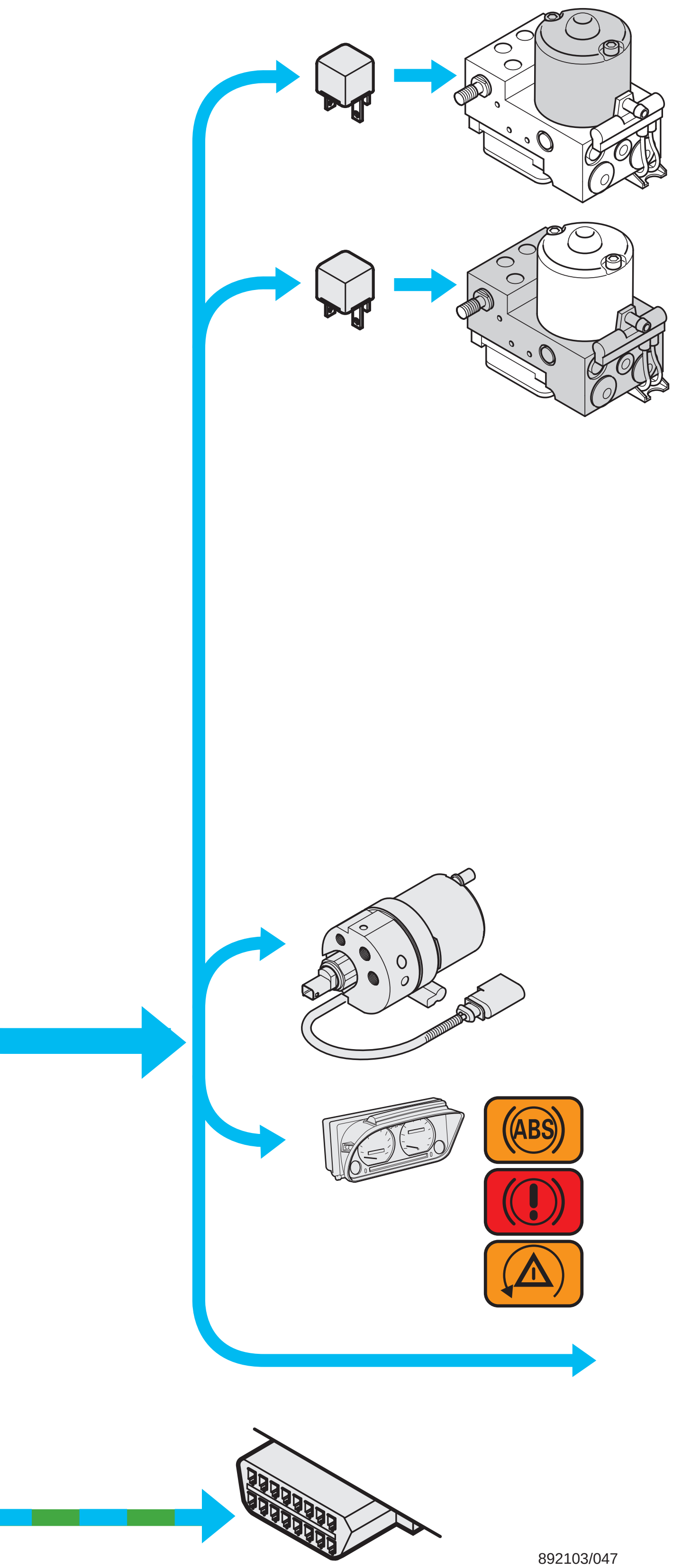
Steering Angle Sensor G85

Combined Sensor for Transverse Acceleration G200 and Sender for Rotation Rate G202

Sender 1 for Brake Booster G201

Auxiliary Signals:
Engine Management System
Transmission Management System





Actuators

ABS Return Flow Pump Relay J105, Near Right HVAC Air Duct

ABS Return Flow Pump V39

ABS Solenoid Valve Relay J106, Near Right HVAC Air Duct

ABS Inlet Valves: Right Front N99, Left Front N101, Right Rear N133, Left Rear N134

ABS Outlet Valves: Right Front N100, Left Front N102, Right Rear N135, Left Rear N136

Pilot Valve -1- Traction Control N225
Pilot Valve -2- Traction Control N226

High Pressure Switch Valve -1- Traction Control N227
High Pressure Switch Valve -2- Traction Control N228

Hydraulic Pump Traction Control V156

Control Module with Indicator Unit in Instrument Panel Insert J285

ABS Warning Light K47

Warning Light for Brake System K118

ASR/ESP Warning Light K155

Auxiliary Signals:
Engine Management System
Transmission Management System

Data Link Connector (DLC)
Wire Connector TV14

Design and Function

Control Cycle

The ABS wheel speed sensors provide a continuous stream of data on speeds for each wheel.

The steering angle sensor is the only sensor which supplies data directly via the CAN data bus to the control module. The control module calculates the desired steering direction and the required handling performance of the vehicle from both sets of information.

The sensor for transverse acceleration signals to the control module when the vehicle breaks away to the side, and the sender for rotation rate signals when the vehicle begins to skid. The control module calculates the actual state of the vehicle from these two sets of information.

If the nominal value and actual value do not match, ESP performs corrective intervention calculations.

ESP decides:

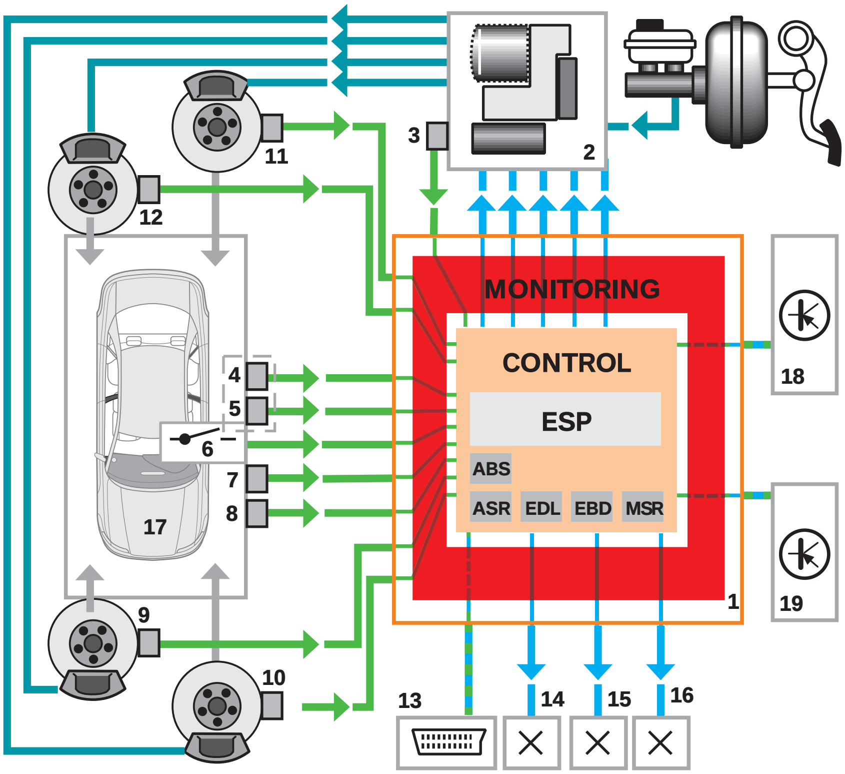
- what wheel to brake or accelerate and to what extent,
- whether engine torque is reduced and
- whether the transmission control module is activated on vehicles with automatic transmission.

The system then checks to see if intervention was successful from the data it receives from the sensors.

If intervention was successful, ESP ends it and continues to monitor the vehicle's handling characteristics.

If unsuccessful, the intervention cycle is repeated.

When corrective intervention is taking place, this is indicated to the driver by the flashing ASR/ESP warning light.

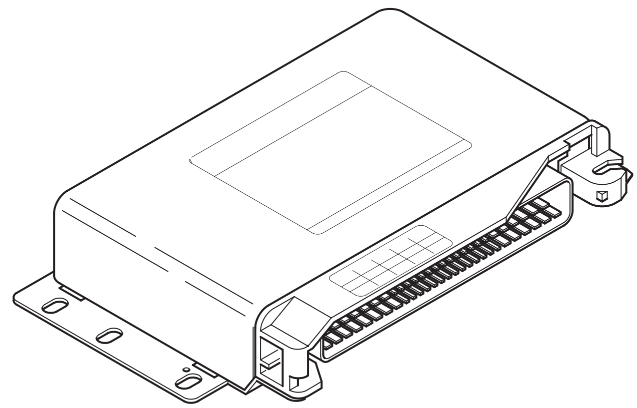


1 ABS Control Module with EDL/ASR/ESP J104
2 ABS Hydraulic Unit N55 with Hydraulic Pump for Traction Control V156
3 Sender 1 for Brake Booster G201
4 Sensor for Tranverse Acceleration G200 (Combined with G202)
5 Sender for Rotation Rate G202 (Combined with G200)
6 Button for ASR/ESP E256
7 Steering Angle Sensor G85
8 Brake Light Switch F
9-12 ABS Wheel Speed Sensors G44, G45, G46, G47
13 Data Link Connector (DLC) Wire Connector TV14
14 Warning Light for Brake System K118
15 ABS Warning Light K47
16 ASR/ESP Warning Light K155
17 Vehicle and Driver Behavior
18 Intervention in Engine Management
19 Intervention in Transmission Control Module (TCM) J217 (Vehicles with Automatic Transmission Only)

892103/048

ABS Control Module with EDL/ASR/ESP J104

In the Bosch ESP system, the control module and the hydraulic unit are separated. The control module is located behind the right side of the instrument panel near the HVAC housing.



892103/049

Design and function

The ABS control module comprises a high-performance microcomputer.

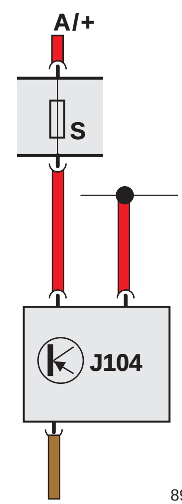
Since a high level of fail-safety is required, the system has two processors as well as its own voltage monitoring device and a diagnostics interface.

The two processors use identical software for information processing and for monitoring each other.

Dual-processor systems of this type have what is known as active redundancy.

Electric circuit

The ABS Control Module with EDL/ASR/ESP J104 obtains its power supply via the positive connection in the dash panel wiring harness.



892103/050

Effects of failure

In the unlikely event of control module failure, the driver will only have use of the standard brake system without ABS, EDL, ASR and ESP.

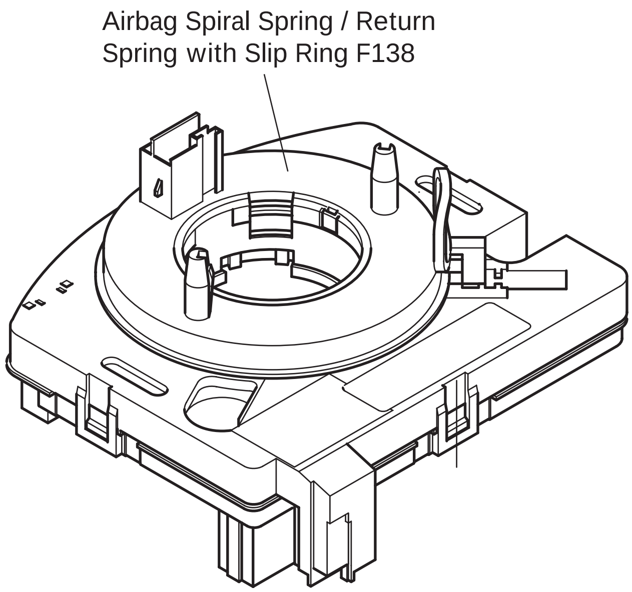
Self-diagnosis

The following faults are detected:

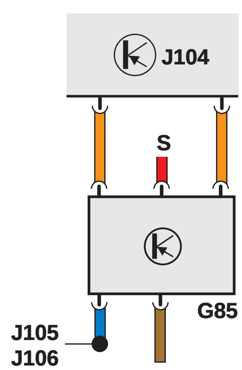
- Control module defective
- Power supply failure

Steering Angle Sensor G85

is mounted on the steering column between the steering column switch and the steering wheel. The Airbag Spiral Spring / Return Spring with Slip Ring F138 is integrated in the Steering Angle Sensor G85 and located on its base.



892103/051



892103/052

Task

The sensor transfers the steering wheel lock angle to the ABS Control Module with EDL/ASR/ESP J104. A measured angle of $\pm 720°$ corresponds to four full turns of the steering wheel.

Electric circuit

Steering Angle Sensor G85 is the only sensor of the ESP system which transfers information directly via the CAN data bus to the control module. After switching on the ignition, the sensor initializes itself as soon as the steering wheel has been rotated through an angle of 4.5°. This is equivalent to a turning movement of approximately 0.6 inch (15 mm).

Effects of failure

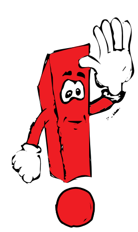
Without the information supplied by the Steering Angle Sensor G85, ESP would be unable to determine the desired direction of travel. The ESP function fails.

Self-diagnosis

After replacing the control module or the sensor, the zero position must be recalibrated.

Faults can include:

- Steering angle sensor – no communication
- Wrong setting
- Mechanical fault
- Defective
- Implausible signal



Faults can occur if the track has become maladjusted. Make sure that the sensor is connected securely to the steering wheel.

Design

The angle is measured using the principle of the light barrier.

The basic components are:

- a light source (A)
- an encoding disc (B)
- optical sensors (C and D)
- a counter (E) for full revolutions

The encoding disc comprises two rings: the absolute ring and the incremental ring. Both rings are scanned by two sensors each.

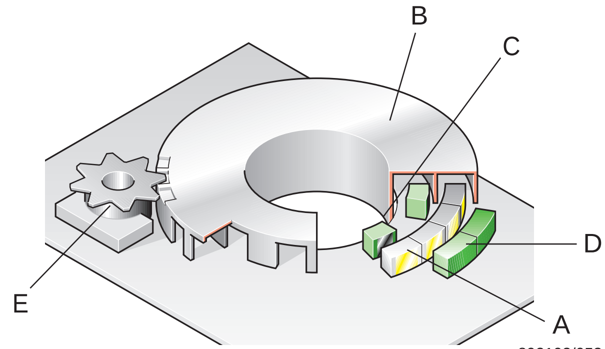
Function

We can simplify the setup by arranging an incremental hole template (1) and an absolute hole template (2) side by side. The light source (3) is positioned in between the hole templates. The optical sensors (4 and 5) are located on the outside.

Light shining on a sensor through a gap generates a signal voltage. If the light source is covered, the voltage drops down again.

Moving the hole templates produces two different voltage sequences. The incremental sensor supplies a uniform signal, since the gaps follow each other at regular intervals. The absolute sensor generates an irregular signal, since light passes through the gaps in the template at irregular intervals. By comparing both signals, the system can calculate how far the hole template has moved. The absolute voltage sequence determines the starting point of the movement.

Designed to send a usable signal to the control module for one steering wheel rotation in one direction at a time, the steering angle sensor uses the same principle.



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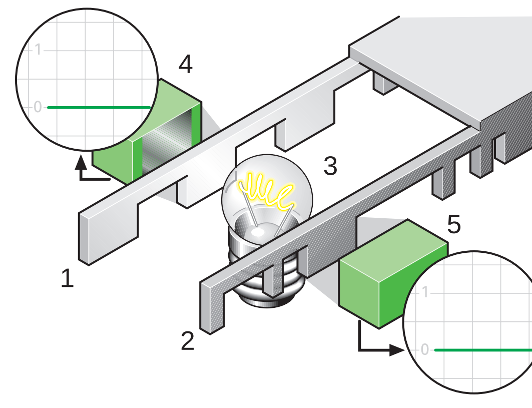

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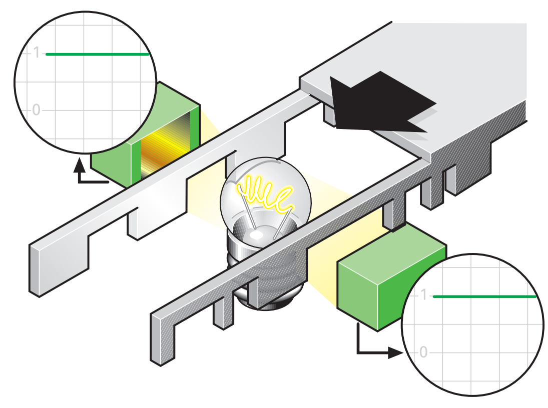

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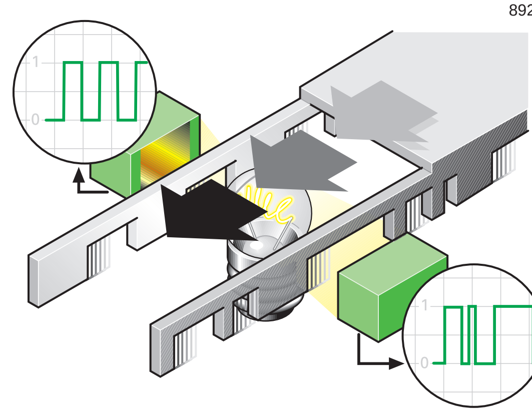

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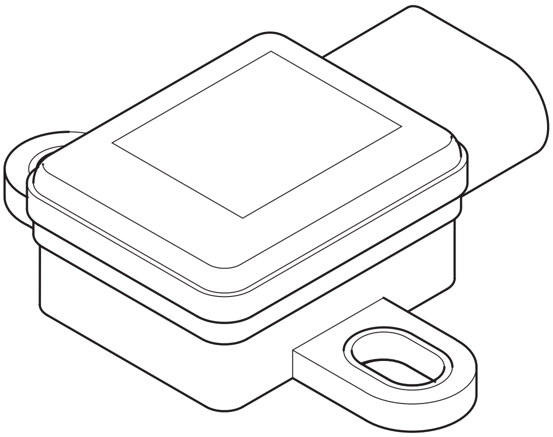
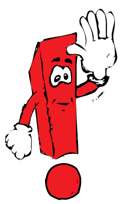


892103/057



This sensor is highly sensitive to damage.

Combined Sensor for Transverse Acceleration G200 and Sender for Rotation Rate G202

is mounted at the base of the passenger side ‘A’ pillar. This component contains sensors to measure both lateral acceleration and steering yaw rate.
Both sensors are mounted on a printed circuit board and operate according to micro-mechanical principles.

The Sensor for Transverse Acceleration G200 determines whether and to what extent lateral forces are causing the vehicle to lose directional stability.

The Sender for Rotation Rate G202 must determine if the vehicle is rotating about its vertical axis. This process is known as measuring the yaw rate.

Effects of failure

Without these signals, the actual vehicle operating state cannot be calculated in the control module. The ESP function fails.

Self-diagnosis

The diagnosis establishes whether an open circuit has occurred, or a short circuit to positive or ground exists.

The system is also able to determine whether the sensor is defective or not.

Design of Sensor for Transverse Acceleration G200

The sensor is a tiny component on the printed circuit board of the combined sensor.

Expressed in simple terms, the Sensor for Transverse Acceleration G200 is a capacitor plate with a moving mass which is suspended so that it can move back and forth. Two additional permanently mounted capacitor plates enclose the movable plate to form two series-connected capacitors (K1 and K2). The quantity of electricity which the two capacitors can absorb can now be measured by means of electrodes. This quantity of electricity is known as capacitance C.

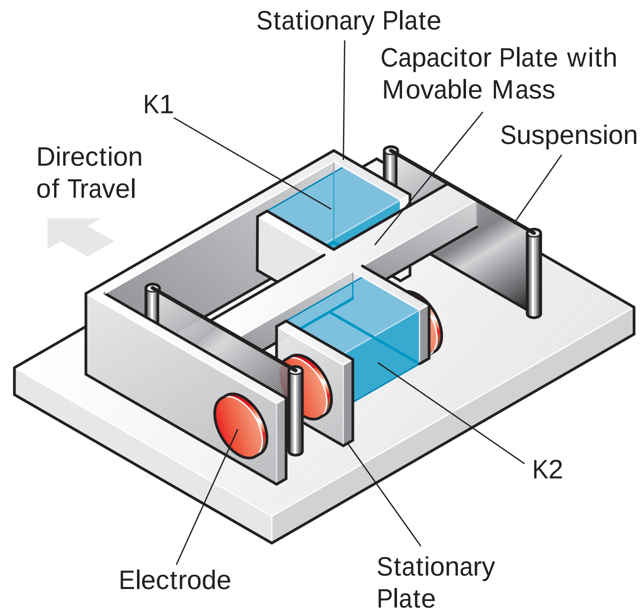
Function

As long as no acceleration acts on this system, the measured quantities of electricity (C1 and C2) of the two capacitors are of equal magnitude.

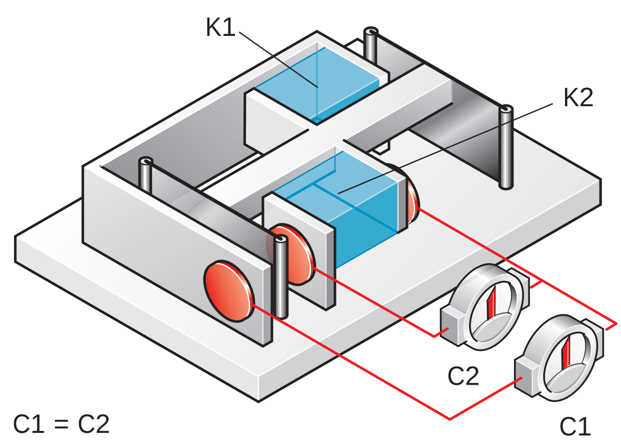
If lateral acceleration acts on the system, the inertia of the movable mass at the center plate causes the part opposite the fixed plate to move against the direction of acceleration. This causes the spacing between the plates to change and this also changes the measured quantities of electricity of each of the capacitors.

The spacing of the plates at capacitor K1 increases and the associated capacitance C1 decreases.

The spacing of the plates at capacitor K2 decreases and capacitance C2 therefore increases.



892103/058



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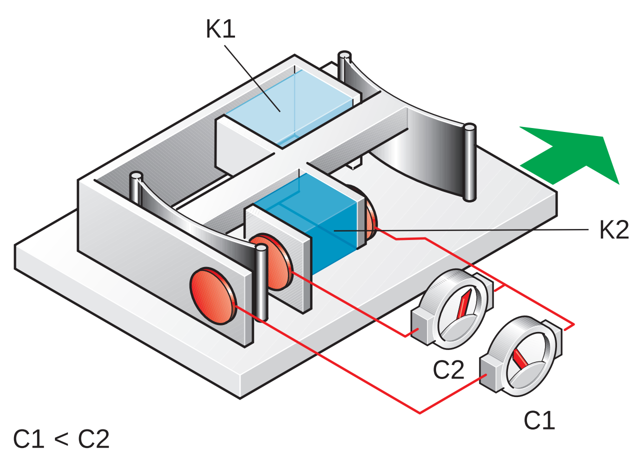

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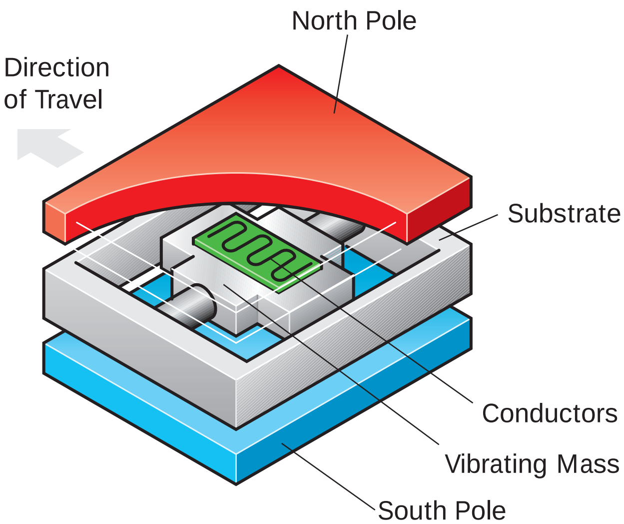
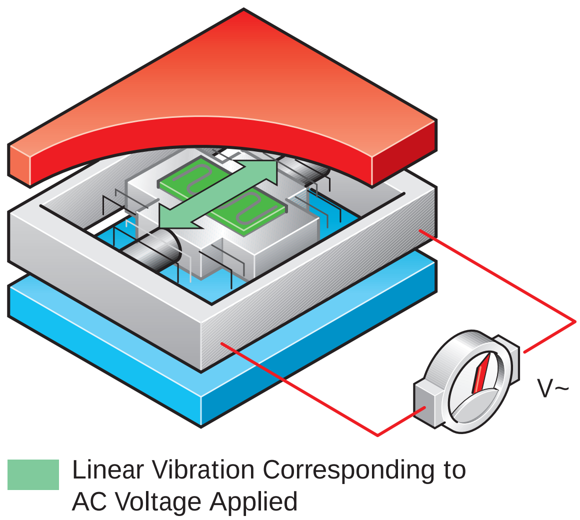
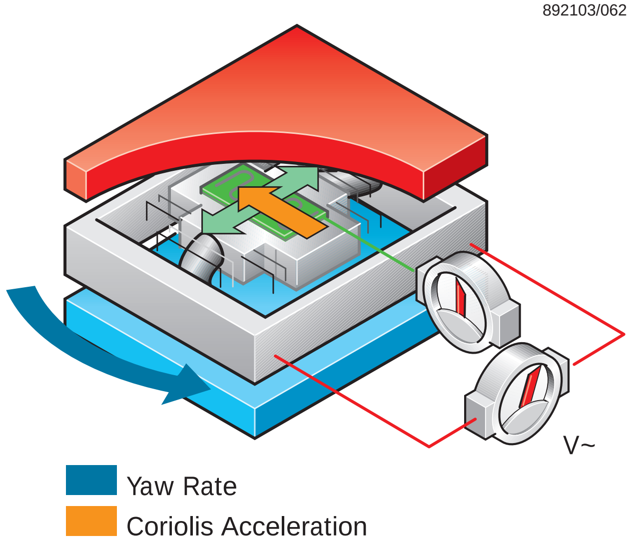


892103-061



892103/062



892103/063

Design of Sender for Rotation Rate G202

The Sender for Rotation Rate G202 is mounted on the same board, but is otherwise separate from the Sensor for Transverse Acceleration G200.

This design can also be explained in simple terms.

Imagine a vibrating mass suspended in a support between the north and south poles of a constant magnetic field. Printed circuits comprising the actual sensor are attached to this vibrating mass.

In the actual sender, this configuration is duplicated for reliability.

Function

If you apply an AC voltage (V~), the part containing the conductors begins to oscillate in the magnetic field.

If angular acceleration acts on this structure, the oscillating mass ceases to oscillate back and forth. Since this occurs in a magnetic field, the electrical behavior of the conductors changes.

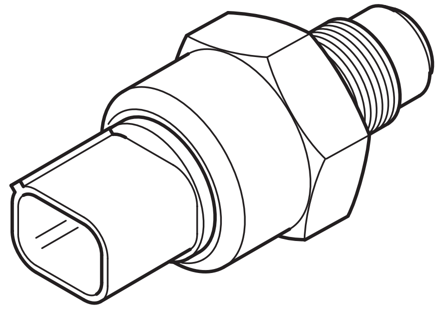
When measured, this change shows the magnitude and direction of the vehicle's rotation around its vertical axis. The evaluation electronics calculate the yaw rate from this data.

Sender 1 for Brake Booster G201

is threaded into the Hydraulic Pump for Traction Control V156.

Task

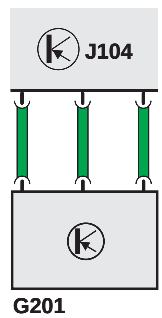
The Sender 1 for Brake Booster G201 signals the momentary pressure in the brake circuit to the control module.
From this, the control module calculates the wheel braking forces and the longitudinal forces acting on the vehicle. If ESP intervention is necessary, the control module allows for this value when calculating the lateral forces.



892103/064

Electric circuit

The Sender 1 for Brake Booster G201 is connected to the ABS Control Module with EDL/ASR/ESP J104 by three wires.



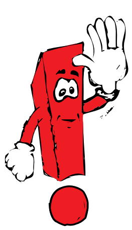
892103/065

Effects of failure

Without values for current brake pressure, the system is no longer able to calculate the lateral forces correctly. The ESP function fails.

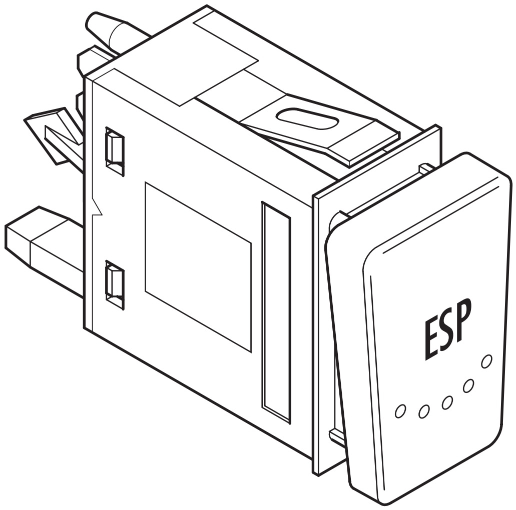
Self-diagnosis

The diagnosis establishes whether an open circuit exists or whether a short circuit to positive or ground has occurred. The system is also able to recognize whether the sensor is defective.



Do not remove the sender from the hydraulic pump.

It must be replaced together with the pump.



892103/066

Button for ASR/ESP E256

This button is located on the instrument panel, just above the radio.

It allows the driver to deactivate the ESP function. When the driver depresses the brake pedal or presses the button again, it reactivates the ESP function.
If the driver forgets to reactivate ESP, the system reactivates itself when the engine is restarted.

It makes sense to deactivate the ESP function in the following situations:

- when trying to free the vehicle from deep snow or loose surfaces by rocking the vehicle back and forth,
- when driving with snow chains installed, and
- to run the vehicle on a dynamometer.

The system cannot be deactivated while ESP intervention is in progress or above a certain speed.

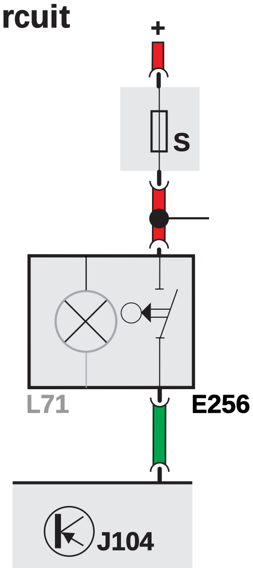
Effects of failure

If the button is defective, the ESP function cannot be deactivated. A malfunction is indicated on the Instrument Panel Control Module with Indicator Unit in Insert J285 by the ASR/ESP Warning Light K155.

Self-diagnosis

The self-diagnosis cannot detect a defective button.

Electric circuit



892103/067

The Hydraulic Pump for Traction Control V156

is mounted below the ABS Hydraulic Unit N55 in the engine compartment on a common support.

Task

In an ABS system, a small quantity of brake fluid must be pumped through the brake master cylinder against a high pressure. This task is performed by the return flow pump. However, the return flow pump cannot provide a large quantity of brake fluid at low or zero pedal pressure because the brake fluid has a viscosity that is too high at low temperature.

The ESP system therefore requires an additional hydraulic pump in order to build up the necessary pre-pressure on the suction side of the return flow pump.

The pressure for pre-charging is limited by an orifice in the master cylinder. The hydraulic pump itself is not regulated.

Electric circuit

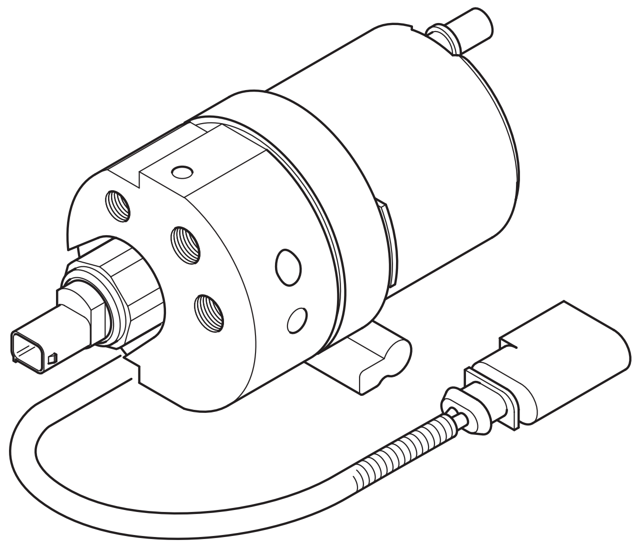
Both wires of the hydraulic pump are connected to ABS Control Module with EDL/ASR/ESP J104.

Effects of failure

The ESP function can no longer be executed. ABS, EDL and ASR functions are not impaired.

Self-diagnosis

The self-diagnosis indicates open circuit as well as short circuit to positive and ground.



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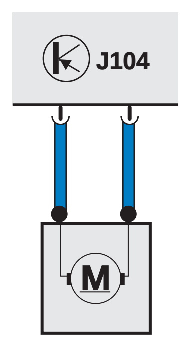
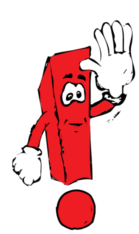
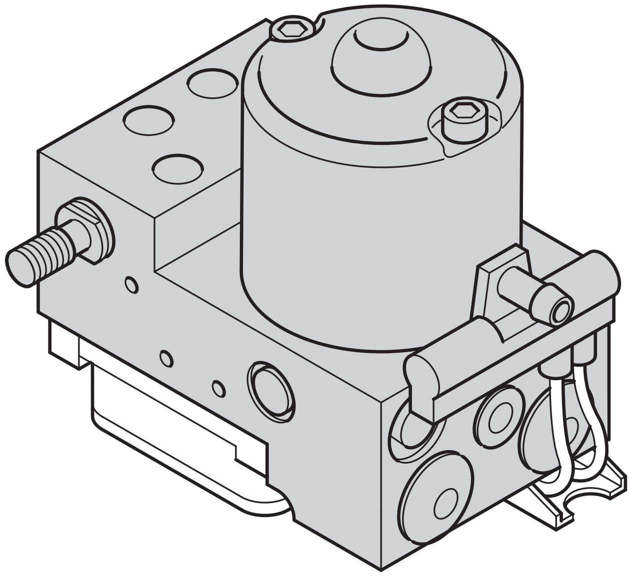


892103/069



Do not repair the hydraulic pump. It must be replaced as a unit.

As a replacement part, the pump is already filled with brake fluid. Do not remove the plug prematurely. Do not use an empty hydraulic pump.



892103/070

The ABS Hydraulic Unit N55

is mounted on a support in the engine compartment. The exact location may vary depending on vehicle type.

Task

The hydraulic unit has two diagonally split brake circuits.

Compared with older ABS units, the hydraulic unit has been modified by the addition of a changeover valve and an intake valve for each brake circuit. The return flow pump is now self priming.

The changeover valves are as follows:

Pilot Valve -1- Traction Control N225
Pilot Valve -2- Traction Control N226

The intake valves are as follows:

High Pressure Switch Valve -1- Traction Control N227
High Pressure Switch Valve -2- Traction Control N228

The individual wheel brake cylinders are activated by the valves in the hydraulic unit. Three states are possible by activating the hydraulic unit inlet and outlet valves for a wheel brake cylinder:

- Raise pressure
- Hold pressure
- Reduce pressure

Effects of failure

If proper functioning of the valves cannot be assured, the complete system is deactivated.

Self-diagnosis

Changeover and intake valves are each checked for open circuit and short circuit to positive and ground.

Warning Lights and Buttons in the Diagnosis

If a fault occurs while ESP corrective intervention is in progress, the system tries its best to complete corrective intervention. At the end of the corrective process, the subsystem is deactivated and the warning light is activated.

Faults and activation of warning lights are always saved to the fault memory.

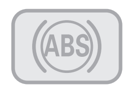
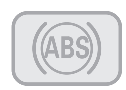
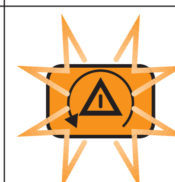
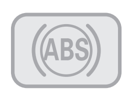
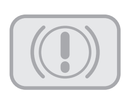
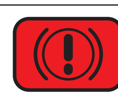
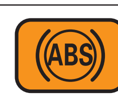
The ESP function can be deactivated by pressing the Button for ASR/ESP F47.

Warning Lights

 Warning Light for Brake System K118

ABS Warning Light K47

 ASR/ESP Warning Light K155

	K118	K47	K155
Ignition "on"			
System OK			
ASR/ESP intervention			
Button for ASR/ESP E256 “off” ABS remains active, ESP is deactivated when coasting and accelerating, but remains active during ABS intervention.			
ASR/ESP failure Fault at Sender for Rotation Rate G202, Sensor for Transverse Acceleration G200, Steering Angle Sensor G85, or Sender 1 for Brake Booster G201; in event of ABS failure, emergency ESP function remains active. EBD remains active.			
ABS failure All systems switch off.			

892103/900

Standard Equipment List

S: Standard, at no additional charge.
O: Option, at additional charge.
P: Part of option package, at additional charge.
— : Not available.

Exterior		GLS	MV	Camper*
Antenna	Front mounted, collapsible antenna	S	S	S
Badging	MV Badge Driver Side, Rear	—	S	—
Brake Lights	Center high mounted stop lamp in top of rear window	S	S	S
Bumpers	Body color bumpers	S	S	S
Doors	3 doors (2 front, 1 side)	S	S	S
	Black door handles	S	S	S
	Rear hatch door with glass window	S	S	S
Glass	Dark tinted glass for privacy from B-pillar back (not available with Weekender)	S	S	—
	Tinted glass, green	S	S	S
Grille	Body color grille with center logo	S	S	S
Horn	Dual tone horns	S	S	S
Lights, Front/Rear	Daytime Running Lights (DRL). Upon start-up of vehicle, headlights are engaged with reduced power; instrument panel lighting, parking lights and taillights remain off. To engage all lights with full power the light switch must be turned to on position.	S	S	S
	Front foglights (without washers)	S	S	S
	Halogen headlamps, glass lens	S	S	S
	Headlights-on warning tone, upon opening of driver's door when ignition key is removed	S	S	S
Mirrors	Body color mirror housings	S	S	S
	Driver & passenger side power mirrors, heatable	S	S	S
Moldings/Panels	Lift gate handle/license plate panel in body color	S	S	S
Paint	Metallic paint	O	O	—
	Non-metallic paint	S	S	S

*Camper not available in Canada.

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S: Standard, at no additional charge.
O: Option, at additional charge.
P: Part of option package, at additional charge.
— : Not available.

Exterior		GLS	MV	Camper*
Roof	Power sunroof (Topslider) with sunshade — not available with Weekender package	O	O	—
	Rooftop luggage carrier with tie-down bars	—	—	S
Tires	Full size steel spare wheel/tire	S	S	S
	P225/60 R 16 H, all season	S	S	S
Wheels/Covers	New 16" alloy wheels (from 15")	S	S	—
	New 16" steel wheels (from 15")	—	—	S
Wipers/Washers	2 speed windshield wipers with 4-speed, programmable intermittent wipe feature	S	S	S
	Heated windshield washer nozzle (front)	S	S	S
	Rear wiper/washer system with intermittent wipe feature	S	S	S
Interior				
Air Conditioning	Air conditioning, CFC-free, with variable displacement A/C compressor	—	P	S
	Climatronic: electronic automatic air conditioning system, CFC-free, dual zone (front and rear), and separate controls in rear. Not available with Weekender Package.	S	S	—
Alarm/Anti-theft	Immobilizer theft deterrent system (Transponder III)	S	S	S
Armrest	Folding armrests (2) for each front seat	S	S	S
Ashtray/Lighter	Illuminated ashtray in front of center console	S	S	S
	Two rear ashtrays in rear side panels	S	S	S
Assist Handles	Assist handles on A-pillars (2) and passenger B-pillar (1), passenger grab handle in headliner, strap on C-pillars (2), coat hooks (4)	—	S	—
	Assist handles on A-pillars (2), passenger grab handle in headliner	—	—	S
	Assist handles on A-pillars (2) and passenger B-pillar (1), passenger grab handle in headlliner, strap on passenger side C-pillar (1), coat hooks (4)	S	—	—
Center Console	See Interior, Storage	—	—	—

*Camper not available in Canada.

Standard Equipment List

S: Standard, at no additional charge.
P: Part of option package, at additional charge.
O: Option, at additional charge.
— : Not available.

Interior		GLS	MV	Camper*
Cruise Control	Cruise control, speed adjustable	S	S	S
Cup Holders	See Interior, Storage	—	—	—
Defroster	Electric rear window defroster	S	S	S
	Electric side mirror defroster/defogger	S	S	S
Doors	Lockable Storage Box in Left Door	S	S	S
Doors/Side Panels	Carpeting on lower front door panels	S	S	S
	Molded door trim with cloth inserts	S	S	S
	Rear side panels, molded, with cloth inserts	S	—	—
	Side panel with fold-up table	—	S	—
Floors/Walls	Carpeting in front passenger area	—	—	S
	Carpeting throughout passenger and cargo areas	S	S	—
Headliner	Molded roof lining — driver compartment	S	S	S
	Molded roof lining with A/C outlets in rear passenger compartment. Not available with Weekender Package.	S	S	—
Heating, Additional	Rear cabin climate controls in front dash, and separate rear cabin climate control in rear	S	S	—
	Rear cabin heater outlet	S	S	S
Instrument Cluster	Brake wear indicator	S	S	S
	Illumination of controls and gauges — blue, with red indicators	S	S	S
	Speedometer, tachometer, odometer, trip odometer, coolant temperature gauge, fuel gauge, gear indicator (if equipped with optional automatic transmission) warning lights, digital clock	S	S	S
Keys	Folding key with new design	S	S	S
	Valet key	S	S	S
Lighter/Outlet	Cigarette lighter (SAE size)	S	S	S

*Camper not available in Canada.

Standard Equipment List

S: Standard, at no additional charge. O: Option, at additional charge.
P: Part of option package, at additional charge. — : Not available.

Interior		GLS	MV	Camper*
Lighting	2 rear dome lights	S	S	—
	2 rear reading lights	S	—	—
	Fluorescent light for passenger area (over folding table)	—	S	—
	Fluorescent lighting over galley	—	—	S
	Side entrance step illumination, switchable	S	S	S
Locks	Central power locking system	S	S	S
	Child safety lock on side sliding door	S	S	S
	Locking fuel cap	S	S	S
	Remote central power locking system	S	S	S
Mirrors, Interior	Driver and front passenger illuminated visor vanity mirrors with covers	S	S	S
Ornamentation	Chrome button for park brake	S	S	S
	Chrome interior door handles and ring on shift knob	S	S	S
Power Outlets	Additional power jacks in passenger and luggage compartments	S	S	S
	Cigarette lighter/power jack	S	S	S
Radio/Audio	AM/FM CD stereo sound system from Winnebago	—	—	O
	Premium V, 6 speaker AM/FM cassette sereo sound system	S	S	—
	Sound system preparation (6 speakers & collapsible antenna), with Winnebago installation of radio	—	—	S
Restraint System	Automatic tensioning retractors for front and rear passenger safety belts, to secure child seat in place	S	S	S
	Driver and front passenger front airbag supplemental restraint system	S	S	S
	Height adjustable front 3-point safety belts, color coordinated	S	S	S
	Passenger compartment rear-facing seats with lap belts	—	S	—
	Passenger compartment third row 3-point safety belts, center lap belt	S	S	—

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Standard Equipment List

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— : Not available.

Interior		GLS	MV	Camper*
Restraint System (Cont'd)	Safety belt pre-tensioners with load limiters, front seats only	S	S	S
	US/Canada — Child seat tether anchorage points, third row (FMVSS 225)	S	S	S
Seating, Front	Driver and passenger front seat with swivel function and manual lumbar adjustment	—	—	S
	Heatable front seats	O	O	—
Seating, Rear	Middle row, 2 removable folding rear-facing seats with dual armrests and adjustable backrests	—	S	—
	Rear 2-place bench, converts to a 74" x 43" bed for two, faces rearward or forward	—	—	S
	Rear 3-place bench, converts to bed (removable)	—	S	—
	Rear 3-place bench, fold and tumble with 2 center armrests	S	—	—
	Rear bench head restraints, height and angle adjustable	S	—	—
	Rear bench head restraints, height adjustable	—	S	S
	Removable center bench (2-person bench in second row)	—	—	O
	Two individual middle row seats replacing bench	S	—	—
Special Features	Weekender Package: Pop-up roof with 2-person bed, manual air conditioning (front only), window screens, fixed driver side rear facing seat with refrigerator in seat base, second battery, 120A generator, sliding window curtains, screen for rear hatch	—	P	—
Steering Wheel	4-spoke padded steering wheel	S	S	S
	Steering wheel deformable/collapsible upon impact	S	S	S
	Theft-deterrent steering column	S	S	S
Storage	Beverage holder (1) in passenger compartment	S	—	S
	Beverage holders (2) in passenger compartment	—	S	—
	Front door storage pockets with rubber liners	S	S	S
	Front seatback magazine/storage pocket	S	S	S
	Lockable Storage Box in Left Door (Driver's side)	S	S	S

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Standard Equipment List

S: Standard, at no additional charge. O: Option, at additional charge.
P: Part of option package, at additional charge. — : Not available.

Interior		GLS	MV	Camper*
Storage (Cont'd)	Passenger compartment storage pockets (driver's side)	S	S	—
	Storage compartment in bottom center of dashboard	S	S	S
Trunk/Cargo Area	Cargo area luggage cover	S	—	—
	Carpet floor covering in cargo compartment	S	S	—
	Grip on inside of trunk lid (to assist closing)	S	S	S
	Pass-through feature for loading of long items (base of bench seat)	S	—	—
	Rear cargo compartment luggage shelf	—	S	—
	Recessed luggage tie-down hooks (4)	S	S	—
	Rubber floor covering in cargo compartment	—	—	S
	Wardrobe closet	—	—	S
Upholstery	"Format" velour seat fabric	S	S	—
	"Orbit" flat woven cloth seat fabric	—	—	S
Ventilation System	Pollen and dust filter	S	S	S
	Rear cabin heater outlet	S	S	S
Windows	Automatic one-touch power front windows with pinch protection	S	S	S
	Front and rear privacy curtains and pleated window shades	—	—	S
	Passenger compartment with sliding middle windows	S	S	—
	Snap-on curtains for side windows	—	S	—
	Two screened windows	—	—	S
Winnebago	AC/DC/LP gas refrigerator (2 cu. ft.)	—	—	S
	Beverage tray —standard (does not replace VWoA cupholder), on side of passenger seat	—	—	S
	Cab storage tie-downs	—	—	S
	Full-size 74" x 43" bed for two in pop-up roof	—	—	S
	LP gas and carbon monoxide detectors	—	—	S

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Standard Equipment List

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— : Not available.

Interior		GLS	MV	Camper*
Winnebago (Cont.d)	Pop-up roof has canvas side-walls with screened windows on three sides	—	—	S
	Pop-up roof rises to create up to 7' of floor to ceiling room/with tip-out roof vent	—	—	S
	Removable center bench (2-person bench in second row)	—	—	S
	Removable companion seat (for second row)	—	—	O
	Stainless steel sink and countertop	—	—	S
	Top bunk bedboard storage	—	—	S
	Two multi-adjustable dining/utility tables	—	—	S
	Two-burner LP gas stove with stainless steel splatter shield	—	—	S
Technical				
Brakes	ABS (anti-lock braking system)	S	S	S
	Harmonized Brake Standard (FMVSS 135)	S	S	S
	New 300 mm brakes (from 280 mm)	S	S	S
	Power assisted front vented disc brakes, rear solid disc brakes	S	S	S
Emissions	OBD II	S	S	S
	ORVR On-board Refueling Vapor Recovery	S	S	S
	TLEV emissions concept	S	S	S
Engine	2.8L 201 hp (150 kW), 181 lbs-ft (245 Nm) torque, 6-cylinder VR6 – 4V, 15° V, gas	S	S	S
	Enhanced On-Board Diagnostics — California	S	S	S
	Gas struts in engine compartment	S	S	S
	New engine cover with VW logo and V6	S	S	S
	Premium unleaded fuel required	S	S	S
Side Impact	Anti-intrusion side door beams	S	S	S
Steering	Power assisted rack and pinion steering	S	S	S

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Standard Equipment List

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P: Part of option package, at additional charge. — : Not available.

Interior		GLS	MV	Camper*
Suspension	Front and rear telescopic shock absorbers	S	S	S
	Front stabilizer bar	S	S	S
	Independent front torsion bar suspension	S	S	S
	Independent rear suspension	S	S	S
Traction Control	ASR (Anti-Slip Regulation) and ESP (Electronic Stabilization Program)	S	S	—
	EDL (Electronic Differential Lock)	S	S	S
Transmission	4-speed automatic, adaptive, with automatic shift lock	S	S	S

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Standard Equipment List

S: Standard, at no additional charge. O: Option, at additional charge.
P: Part of option package, at additional charge. — : Not available.

Warranty – Canada		**GLS**	**MV**	**Camper***
Anti-Corrosion	8 year unlimited distance Limited Warranty Against Corrosion Perforation	S	S	—
Maintenance	2 year/40,000 km (whichever occurs first) no charge scheduled manufacturer's maintenance	S	S	—
Powertrain Warranty	5 year/80,000 km (whichever occurs first) Limited Powertrain Warranty. 5 year/80,000 km coverage for first and subsequent owners in Canada.	S	S	—
Roadside Assistance	2 year/unlimited distance 24-hour roadside assistance	S	S	—
Vehicle Warranty	2 year/40,000 km (whichever occurs first) Limited New Vehicle Warranty. Wear & tear items and adjustments excluded after initial 12 months or 20,000 km (whichever occurs first).	S	S	—
	EDL (Electronic Differential Lock)	S	S	—
Warranty – US		**GLS**	**MV**	**Camper***
Anti-Corrosion	8 year unlimited distance Limited Warranty Against Corrosion Perforation	S	S	S
Maintenance	2 year/24,000 mile (whichever occurs first) no charge scheduled manufacturer's maintenance	S	S	S
Powertrain Warranty	5 year/50,000 mile (whichever occurs first) Limited Powertrain Warranty. 5 year/50,000 mile (whichever comes first) coverage for first and subsequent owners.	S	S	S
Roadside Assistance	2 year/unlimited distance 24-hour roadside assistance	S	S	S
Vehicle Warranty	2 year/24,000 mile (whichever occurs first) Limited New Vehicle Warranty. Wear & tear items and adjustments excluded after initial 12 months/12,000 miles (whichever occurs first).	S	S	S

*Camper not available in Canada.

EuroVan GLS 2.8L VR6 – 4V Technical Specifications

Engine	
Type	6-cylinder, 15 degree in-line V (VR6 – 4V)
Bore	3.19 in (81.0 mm)
Stroke	3.54 in (90.0 mm)
Displacement	170.3 cubic in (2 792 cubic cm)
Compression Ratio	10.0:1
Horsepower (SAE) @ rpm	201 @ 6200 (150 kW @ 6200)
Max. Torque, lbs-ft @ rpm	181 @ 2500 – 5500 (245 Nm @ 2500 – 5500)
Fuel Requirement	Premium unleaded (91 AKI recommended)
Engine Design	
Arrangement	Front mounted, transverse
Cylinder Block	Cast iron
Crankshaft	Forged steel, seven main bearings
Cylinder Head	Aluminum alloy, cross flow
Valve Train	Two overhead camshafts, chain driven, 4 valves per cylinder, maintenance free hydraulic lifters
Cooling System	Water cooled, water pump, cross flow radiator, thermostatically controlled electric 3-speed radiator fan
Lubrication	Rotary gear pump, intermediate shaft driven, oil cooler
Fuel/Air Supply	Sequential multi-point fuel injection (Motronic)
Emission	OBD II, TLEV, 3-way catalytic converter with two oxygen sensors (upstream and downstream), enhanced evaporation system, California cars with secondary air injection pump, onboard refueling vapor recovery
Electrical System	
Generator, Volts/Amps	14/150
Battery, Volts (Amp Hours)	12 (60)
Ignition	Digital electronic with dual knock sensors
Firing Order	1-5-3-6-2-4

EuroVan GLS 2.8L VR6 – 4V Technical Specifications

Drivetrain							
Drivetrain	Front Wheel Drive						
Transmission Gear Ratio	1st	2nd	3rd	4th	5th	Reverse	Final
Manual	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Automatic	2.71:1	1.55:1	1.00:1	0.68:1	N.A.	2.11:1	4.91:1
Capacities							
Engine Oil (with filter)	5.8 qt (5.5 L)						
Fuel Tank	21.1 gal (80.0 L)						
Coolant System	11.4 qt (10.8 L)						
Wiper Fluid	7.4 qt (7.0 L)						
Steering							
Type	Rack and pinion, power assisted						
Turns (lock to lock)	3.50						
Turning Circle (curb to curb)	43.3 ft (13.2 m)						
Ratio	19.3:1						
Interior Volumes – SAE							
EPA	Van						
Passenger Volume	178 cubic ft (5.0 cubic m)						
Trunk Volume	20 cubic ft (0.5 cubic m)						
Seating Capacity	7						
	Front			Rear			
Volume	46.0 cubic ft (1.30 cubic m)			166.6 cubic ft (4.72 cubic m)			
Head Room	39.3 in (998 mm)			41.3 in (1 049 mm)			
Shoulder Room	60.4 in (1 534 mm)			63.6 in (1 615 mm)			
Leg Room	37.8 in (960 mm)			28.3 in (719 mm)			

EuroVan GLS 2.8L VR6 – 4V Technical Specifications

Body, Chassis and Suspension				
Type	Unitized construction, bolt-on front fenders			
Front Suspension	Independent/double wishbone with oscillation dampers and longitudinally located torsion bars			
Rear Suspension	Independent with diagonal trailing arms, mini block coil springs, telescopic shock absorbers			
Service Brake	Power assisted, load sensitive, dual diagonal circuits, vented front (300 mm) discs and solid rear discs			
Antilock Braking System	Standard, all four wheels			
Parking Brake	Mechanical, effective on rear wheels			
Wheels	7 J x 16 ET 49, alloys, 5 bolts			
Tires	P225/60 R 16 H, all season tires			
Drag Coefficient	0.36			
Exterior Dimensions				
Wheelbase	115.0 in (2 920 mm)			
Front Track	62.6 in (1 589 mm)			
Rear Track	61.2 in (1 554 mm)			
Length	188.5 in (4 789 mm)			
Width	72.4 in (1 840 mm)			
Height	76.4 in (1 940 mm)			
Ground Clearance	7.1 in (180 mm)			
Weights				
	Curb Weight		Payload	
Manual Transmission	N.A.		N.A.	
Automatic Transmission	4,285 lb (1 945 kg)		1,553 lb (705 kg)	
Fuel Consumption				
	City mpg	City L/100 km	Highway mpg	Highway L/100 km
Manual Transmission	N.A.	N.A.	N.A.	N.A.
Automatic Transmission	15	17.7	20	10.2
Performance 0 – 60 mph (0 – 97 km/h)	Manual Transmission N.A., Automatic Transmission N.A.			

EuroVan MV 2.8L VR6 – 4V Technical Specifications

Engine	
Type	6-cylinder, 15 degree in-line V (VR6 – 4V)
Bore	3.19 in (81.0 mm)
Stroke	3.54 in (90.0 mm)
Displacement	170.3 cubic in (2 792 cubic cm)
Compression Ratio	10.0:1
Horsepower (SAE) @ rpm	201 @ 6200 (150 kW @ 6200)
Max. Torque, lbs-ft @ rpm	181 @ 2500 – 5500 (245 Nm @ 2500 – 5500)
Fuel Requirement	Premium unleaded (91 AKI recommended)
Engine Design	
Arrangement	Front mounted, transverse
Cylinder Block	Cast iron
Crankshaft	Forged steel, seven main bearings
Cylinder Head	Aluminum alloy, cross flow
Valve Train	Two overhead camshafts, chain driven, 4 valves per cylinder, maintenance free hydraulic lifters
Cooling System	Water cooled, water pump, cross flow radiator, thermostatically controlled electric 3-speed radiator fan
Lubrication	Rotary gear pump, intermediate shaft driven, oil cooler
Fuel/Air Supply	Sequential multi-point fuel injection (Motronic)
Emission	OBD II, TLEV, 3-way catalytic converter with two oxygen sensors (upstream and downstream), enhanced evaporation system, California cars with secondary air injection pump, onboard refueling vapor recovery
Electrical System	
Generator, Volts/Amps	14/150
Battery, Volts (Amp Hours)	12 (60)
Ignition	Digital electronic with dual knock sensors
Firing Order	1-5-3-6-2-4

EuroVan MV 2.8L VR6 – 4V Technical Specifications

Drivetrain							
Drivetrain	Front Wheel Drive						
Transmission Gear Ratio	1st	2nd	3rd	4th	5th	Reverse	Final
Manual	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Automatic	2.71:1	1.55:1	1.00:1	0.68:1	N.A.	2.11:1	4.91:1
Capacities							
Engine Oil (with filter)	5.8 qt (5.5 L)						
Fuel Tank	21.1 gal (80.0 L)						
Coolant System	11.4 qt (10.8 L)						
Wiper Fluid	7.4 qt (7.0 L)						
Steering							
Type	Rack and pinion, power assisted						
Turns (lock to lock)	3.50						
Turning Circle (curb to curb)	43.3 ft (13.2 m)						
Ratio	19.3:1						
Interior Volumes – SAE							
EPA	Van						
Passenger Volume	187 cubic ft (5.3 cubic m)						
Trunk Volume	19 cubic ft (0.5 cubic m)						
Seating Capacity	7						
	Front			Rear			
Volume	46.0 cubic ft (1.30 cubic m)			166.6 cubic ft (4.72 cubic m)			
Head Room	39.3 in (998 mm)			41.3 in (1 049 mm)			
Shoulder Room	60.4 in (1 534 mm)			63.6 in (1 615 mm)			
Leg Room	37.8 in (960 mm)			28.3 in (719 mm)			

EuroVan MV 2.8L VR6 – 4V Technical Specifications

Body, Chassis and Suspension				
Type	Unitized construction, bolt-on front fenders			
Front Suspension	Independent/double wishbone with oscillation dampers and longitudinally located torsion bars			
Rear Suspension	Independent with diagonal trailing arms, mini block coil springs, telescopic shock absorbers			
Service Brake	Power assisted, load sensitive, dual diagonal circuits, vented front (300 mm) discs and solid rear discs			
Antilock Braking System	Standard, all four wheels			
Parking Brake	Mechanical, effective on rear wheels			
Wheels	7 J x 16 ET 49, alloys, 5 bolts			
Tires	P225/60 R 16 H, all season tires			
Drag Coefficient	0.36			
Exterior Dimensions				
Wheelbase	115.0 in (2 920 mm)			
Front Track	62.6 in (1 589 mm)			
Rear Track	61.2 in (1 554 mm)			
Length	188.5 in (4 789 mm)			
Width	72.4 in (1 840 mm)			
Height	76.4 in (1 940 mm)			
Ground Clearance	7.1 in (180 mm)			
Weights				
	Curb Weight		Payload	
Manual Transmission	N.A.		N.A.	
Automatic Transmission	4,474 lb (2 031 kg)		1,386 lb (629 kg)	
Fuel Consumption				
	City mpg	City L/100 km	Highway mpg	Highway L/100 km
Manual Transmission	N.A.	N.A.	N.A.	N.A.
Automatic Transmission	15	17.7	20	10.2
Performance 0 – 60 mph (0 – 97 km/h)	Manual Transmission N.A., Automatic Transmission N.A.			

EuroVan Camper 2.8L VR6 – 4V Technical Specifications*

Engine	
Type	6-cylinder, 15 degree in-line V (VR6 – 4V)
Bore	3.19 in (81.0 mm)
Stroke	3.54 in (90.0 mm)
Displacement	170.3 cubic in (2 792 cubic cm)
Compression Ratio	10.0:1
Horsepower (SAE) @ rpm	201 @ 6200 (150 kW @ 6200)
Max. Torque, lbs-ft @ rpm	181 @ 2500 – 5500 (245 Nm @ 2500 – 5500)
Fuel Requirement	Premium unleaded (91 AKI recommended)
Engine Design	
Arrangement	Front mounted, transverse
Cylinder Block	Cast iron
Crankshaft	Forged steel, seven main bearings
Cylinder Head	Aluminum alloy, cross flow
Valve Train	Two overhead camshafts, chain driven, 4 valves per cylinder, maintenance free hydraulic lifters
Cooling System	Water cooled, water pump, cross flow radiator, thermostatically controlled electric 3-speed radiator fan
Lubrication	Rotary gear pump, intermediate shaft driven, oil cooler
Fuel/Air Supply	Sequential multi-point fuel injection (Motronic)
Emission	OBD II, TLEV, 3-way catalytic converter with two oxygen sensors (upstream and downstream), enhanced evaporation system, California cars with secondary air injection pump, onboard refueling vapor recovery
Electrical System	
Generator, Volts/Amps	14/120
Battery, Volts (Amp Hours)	12 (60)
Ignition	Digital electronic with dual knock sensors
Firing Order	1-5-3-6-2-4

*Camper not available in Canada.

EuroVan Camper 2.8L VR6 – 4V Technical Specifications*

Drivetrain							
Drivetrain	Front Wheel Drive						
Transmission Gear Ratio	1st	2nd	3rd	4th	5th	Reverse	Final
Manual	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Automatic	2.71:1	1.55:1	1.00:1	0.68:1	N.A.	2.11:1	4.91:1
Capacities							
Engine Oil (with filter)	5.8 qt (5.5 L)						
Fuel Tank	21.1 gal (80.0 L)						
Coolant System	11.4 qt (10.8 L)						
Wiper Fluid	7.4 qt (7.0 L)						
Steering							
Type	Rack and pinion, power assisted						
Turns (lock to lock)	3.50						
Turning Circle (curb to curb)	47.2 ft (14.4 m)						
Ratio	19.3:1						
Interior Volumes – SAE							
EPA	Van						
Passenger Volume	107 cubic ft (3.0 cubic m)						
Trunk Volume	5 cubic ft (0.2 cubic m)						
Seating Capacity	4						
	Front			Rear			
Volume	N.A.			N.A.			
Head Room	N.A.			N.A.			
Shoulder Room	N.A.			N.A.			
Leg Room	N.A.			N.A.			

*Camper not available in Canada.

EuroVan Camper 2.8L VR6 – 4V Technical Specifications*

Body, Chassis and Suspension	
Type	Unitized construction, bolt-on front fenders
Front Suspension	Independent/double wishbone with oscillation dampers and longitudinally located torsion bars
Rear Suspension	Independent with diagonal trailing arms, mini block coil springs, telescopic shock absorbers
Service Brake	Power assisted, load sensitive, dual diagonal circuits, vented front (300 mm) discs and solid rear discs
Antilock Braking System	Standard, all four wheels
Parking Brake	Mechanical, effective on rear wheels
Wheels	6.0 J x 16 steel wheels with full covers
Tires	P225/60 R 16 H, all season tires
Drag Coefficient	0.36

Exterior Dimensions	
Wheelbase	130.7 in (3 320 mm)
Front Track	62.6 in (1 589 mm)
Rear Track	61.2 in (1 554 mm)
Length	204.3 in (5 189 mm)
Width	72.4 in (1 840 mm)
Height	80.0 in (2 032 mm)
Ground Clearance	6.7 in (171 mm)

Weights		
	Curb Weight	Payload
Manual Transmission	N.A.	N.A.
Automatic Transmission	5,302 lb (2 373 kg)	694 lb (345 kg)

Fuel Consumption				
	City mpg	City L/100 km	Highway mpg	Highway L/100 km
Manual Transmission	N.A.	N.A.	N.A.	N.A.
Automatic Transmission	14	17.9	19	10.6

Performance 0 – 60 mph (0 – 97 km/h)	Manual Transmission N.A., Automatic Transmission N.A.

*Camper not available in Canada.

Notes

The EuroVan, Model Year 2001 Teletest

The test for this course, number 892103, has been prepared and shipped as a separate document. Please refer to your copy of that document and follow the testing instructions to complete the Teletest.

Additional copies are available by contacting:

Certification Program Headquarters
Toll-free Hotline & Testing 1-877-CU4-CERT (1-877-284-2378)
Fax: 1-877-FX4-CERT (1-877-394-2378)

Hotline assistance is available Monday – Friday
between 9:00 a.m. and 5:00 p.m., EST.