The Volkswagen 4.2-Liter V8-5V Engine Design and Function

Self-Study Program
Course Number 89S303

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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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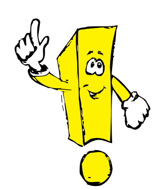
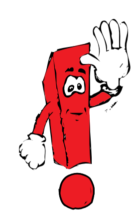
New!



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.

The 4.2L V8-5V Engine

The 4.2L V8-5V engine is new to Volkswagen.

Special features of the 4.2L V8-5V engine include the following:

- Aluminum block with no liners.
- Aluminum five-valve cylinder head with roller rockers.
- Camshaft adjustment.
- Three-stage variable intake manifold.
- Engine management system, Bosch Motronic ME 7.1.1.
- Water-cooled 190-ampere generator.
- Crankcase with a large flange pattern.
- Crankshaft with a ten-hole flange.
- Oil filter module with integrated oil cooler.
- Non-return fuel supply system.
- Seven-ribbed poly V-belt drive.
- Low-Emission Vehicle (LEV) exhaust emission standards.
- Two hot film air mass meters with integrated air temperature sensors.
- Single ignition coils with integrated output stages.
- Two controlled fuel pumps.
- Two electric cooling fans.

Special design features specific to the Touareg application include:

- Special seals to accommodate the Touareg water hazard fording capabilities.
- Pressure and purge oil pump for off-road use.
- Accessories adapted for fording water hazards.
- Deep oil sump for operation on steep and offset grades.

SSP297/101

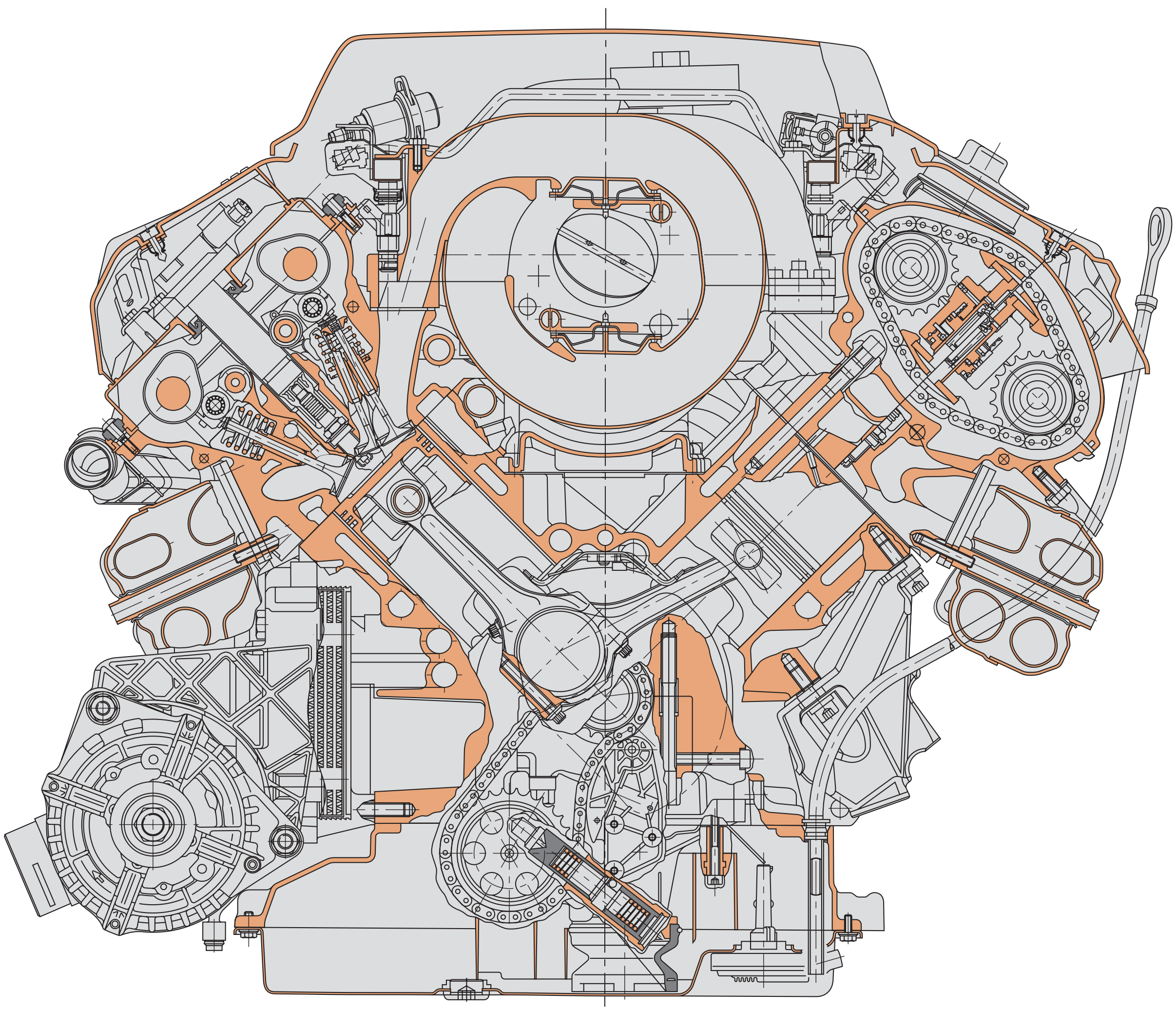
Development of the V8-5V Engine

Emphasis was placed on the following development objectives:

- Compliance with future exhaust-emission regulations.
- Reduction of fuel consumption.
- Increase in torque and power.
- Improvement of comfort and convenience.
- Reduction of engine weight.
- Increased use of shared components.

Alloys are used extensively:

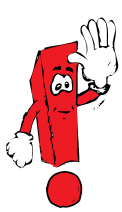
- The cylinder heads and oil sump top section are made of aluminum.
- The valve covers are die-cast magnesium coated with a thin synthetic material to prevent corrosion.
- The cylinder block is aluminum.



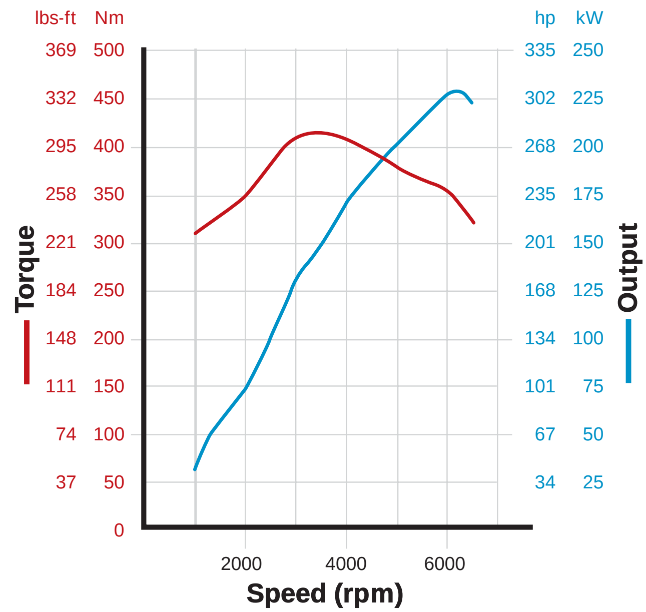
SSP217/055

Technical Data – 4.2-Liter V8-5V Gasoline Engine

- **Type**
  V8 engine with 90 degree V-angle, five valves per cylinder, and variable intake and exhaust valve timing
- **Displacement**
  255 cu in (4172 cm³)
- **Bore**
  3.32 in (84.5 mm)
- **Stroke**
  3.66 in (93.0 mm)
- **Compression ratio**
  11:1
- **Maximum power output**
  310 bhp (228 kW) @ 6200 rpm
- **Maximum torque**
  302 lbs-ft (410 Nm) @ 3000 to 4000 rpm
- **Engine management**
  Motronic ME 7.1.1
- **Firing sequence**
  1-5-4-8-6-3-7-2
- **Fuel type recommendation**
  Premium unleaded gasoline (91 AKI)



The specified power data is only possible if 91 AKI fuel is used. A reduction in power output must be expected if lower grade fuel is used.



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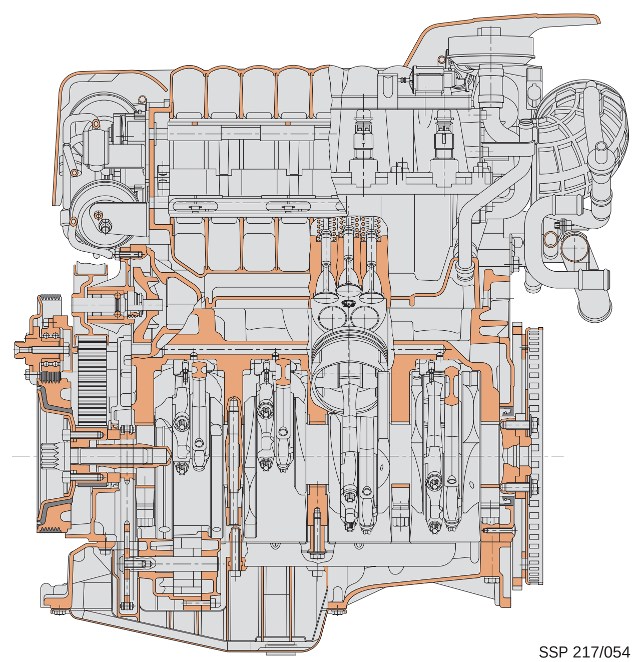

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Crankcase

The 4.2-liter V8-5V engine crankcase components embody many of the innovations developed for Volkswagen engines over the years.

The cylinder block is cast in hypereutectic alloy of aluminum with a 17% silicon content.

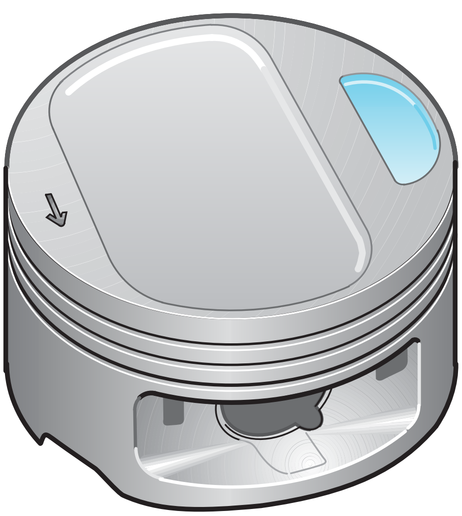
Cylinder areas are specially treated to etch away the aluminum and expose the hard silicon crystals as a bearing surface for the pistons and piston rings. This means that conventional cylinder sleeves are not needed.

A fully balanced heat treated steel crankshaft is used.

It is forged in a single plane and twisted while it is still hot so the rod journals are at 90° to each other. This process ensures the optimum formation of the crankshaft counterweights. The counterweights continue the momentum of the power strokes from cylinder to cylinder for smooth engine operation.

SSP 217/006

Cold-cracked connecting rods have been used by Volkswagen since 1995. They are also used on the 4.2-liter V8-5V engine.



SSP 217/002

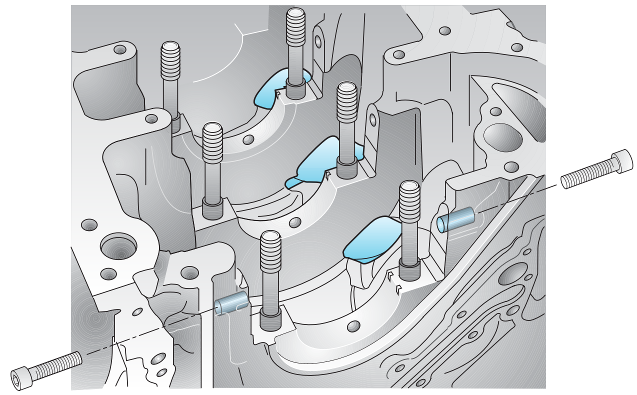
The aluminum slipper-skirt pistons are electroplated with iron, and then thinly coated with tin. In this way, the pistons and cylinder bores seat in together during the engine break-in period to give low-wear moving surfaces.

Recesses are designed into the tops of pistons to provide clearance for valves. Pistons are not interchangeable between cylinder banks.

Wide, milled ventilation recesses above the thrust bearings reduce pumping losses.

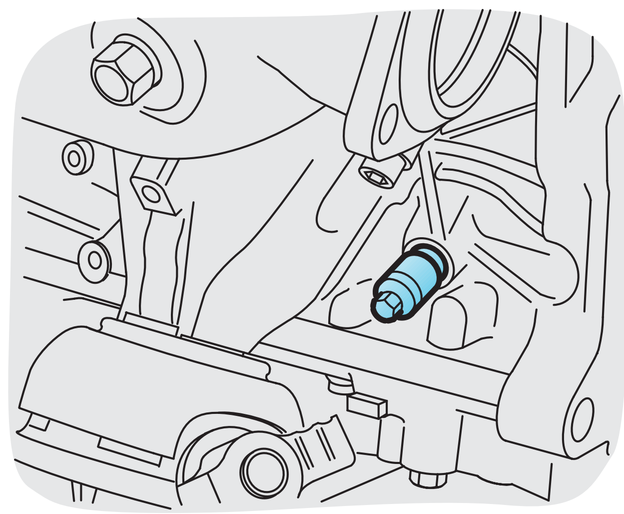
The crankshaft bearing caps are cast in nodular iron for strength and reduce the expansion of the main bearings in the aluminum cylinder block when the engine is hot.

Bolts are also inserted at the sides of the two front crankshaft bearing caps to improve running smoothness.



SSP 217/007

The locking mandrel 3242 used for the V6 engines is also used for locking the crankshaft on the V8-5V engines. It is inserted into the crank web of the fourth cylinder and is used for basic engine adjustment and also as a counterhold for loosening and tightening the central bolt of the crankshaft.



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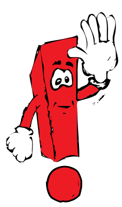
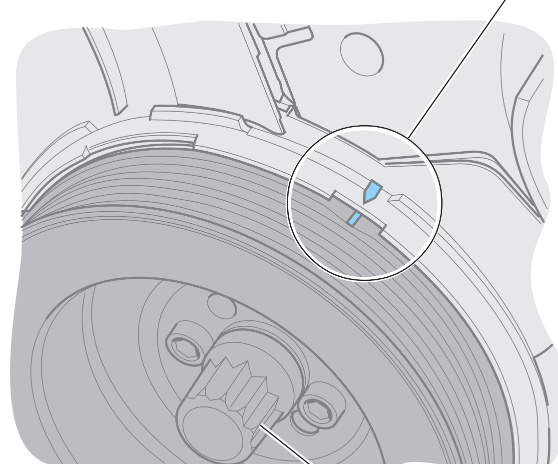


The fifth cylinder must be set to ignition TDC.

The central bolt does not have to be removed for the vibration damper to be removed.

The marking indicates the TDC of the fifth cylinder.



SSP 217/050

Engine Lubrication

The 4.2-liter V8-5V engine lubrication circuit includes:

- Crankshaft driven oil pump.
- Electrical oil level display (a dynamic oil pressure monitoring feature is planned for later introduction).
- Oil filter and cooler module with integrated heat exchanger.
- Two oil pressure retention valves in the engine block.
- Crankshaft flange seals at front and rear.

Several features that are unique to the Touareg application include:

- Front crankshaft oil seal is supplemented by a felt seal ring to accommodate the fording of water hazards.
- Crankcase breather adapted for off-road use.

To help to maintain proper oil flow under extreme driving conditions, the crankcase breather has been designed for off-road use with a feed behind the throttle valve above the governor valve.

The oil holes in the vent plate which can be found in the crankcase breather space between the cylinder heads have been optimized for uphill and downhill operation.

At the rear, a siphon is employed to ensure the oil supply on steep grades.

A duocentric oil pump is driven by the crankshaft via a chain.

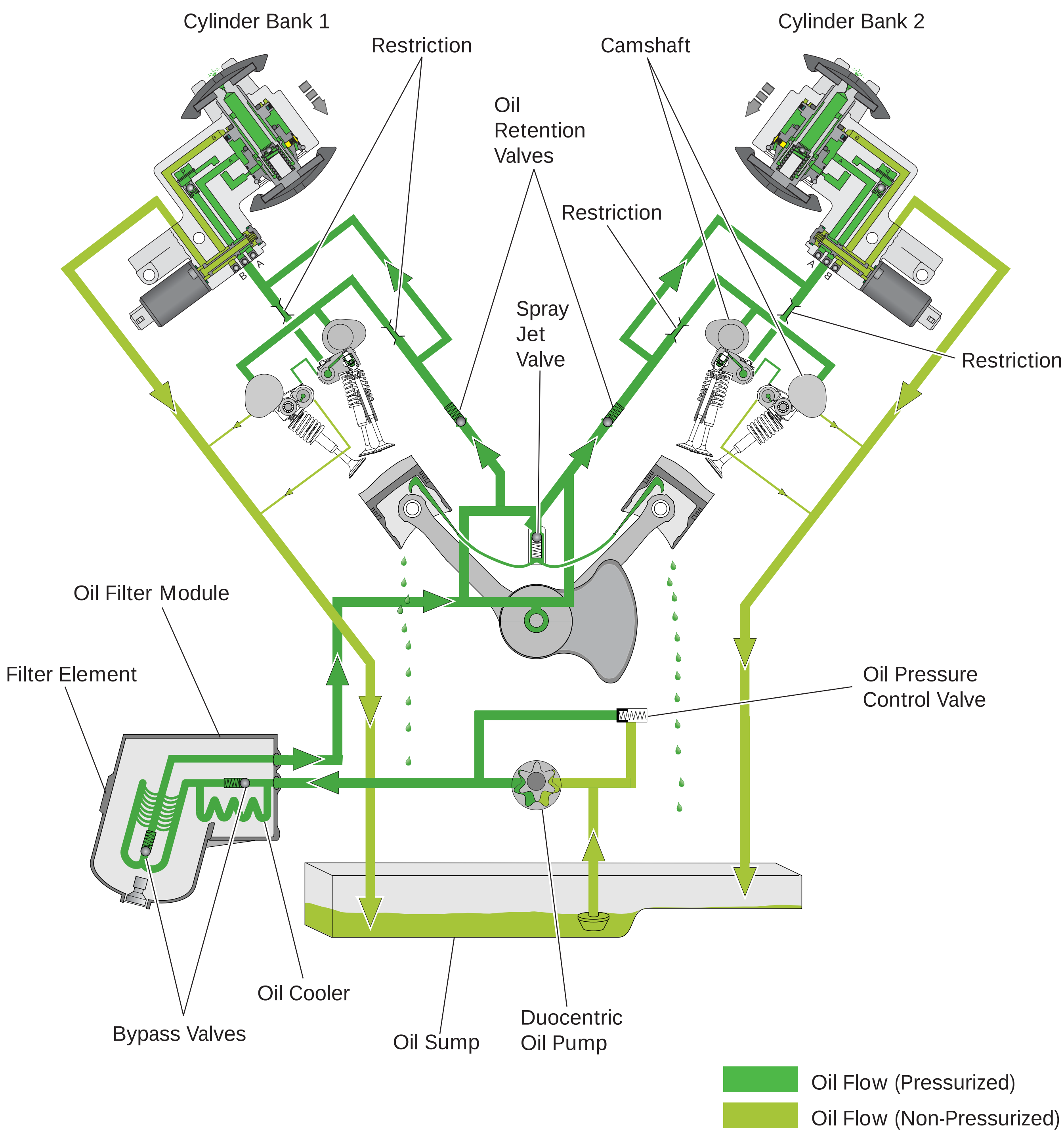
The duocentric oil pump extends deep into the oil sump. The low suction height means that the oil pressure can build up quickly, especially with cold starts.

The oil-pressure control valve is located in the oil pump housing. The “diverted” oil is led off to the intake side of the oil pump. This helps optimize the level of efficiency.

There are five oil bores per triple roller rocker. Three oil bores each supply one hydraulic tappet. Two oil bores supply the oil-spray bores integrated in the roller rocker to lubricate the rollers. The oil-spray bores are only opened when the roller rockers are actuated. This results in a reduction of the amount of oil required in the cylinder head.

The Engine Oil Level Sensor G12 functions as an information sender for the oil level warning display in the instrument cluster.

Engine Oil Circuit
(Phaeton Shown, Touareg Similar)



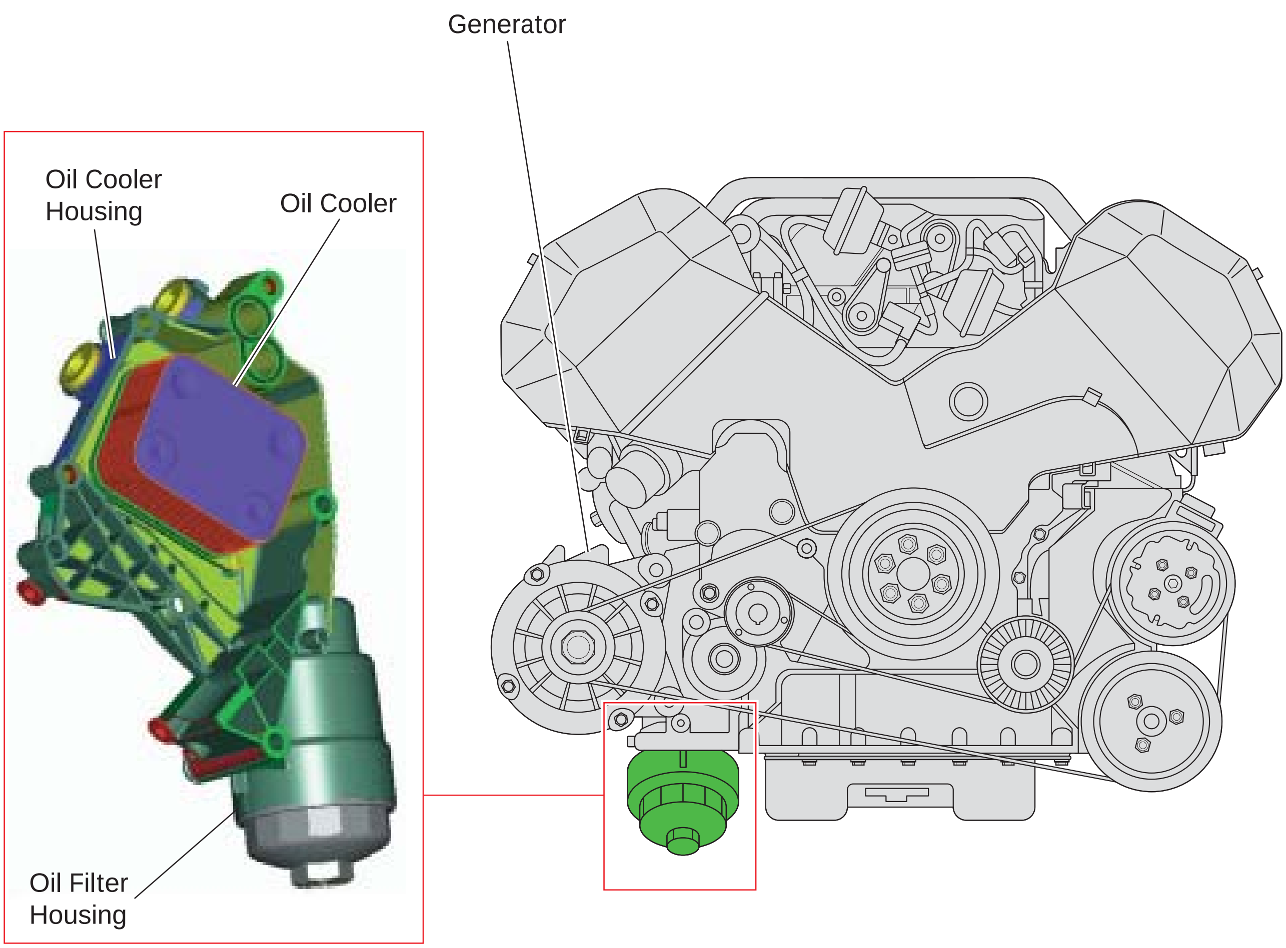
SSP 217/011

Touareg Oil Filter Module

The oil filter module has been especially designed for the Touareg application.

The new oil filter housing and oil cooler housing are integrated into a single module that bolts directly to the engine crankcase and sits high.

The oil filter housing provides the mounting surface for the generator. The generator is mounted high to enhance the vehicle's fording capability. Both the oil cooler and the generator are cooled by circulating engine coolant.



SSP217/101

Touareg Oil Pan

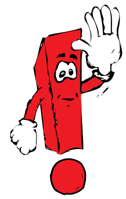
The Touareg application of the 4.2-liter V8-5V engine has a deep oil pan to ensure an adequate supply of oil on extreme upslopes and downslopes.

The oil pan is a two-piece design comprised of an upper and lower pan.

Total engine oil capacity is approximately 9.5 quarts (9 liters).

Oil pan components are sealed with RTV sealant.

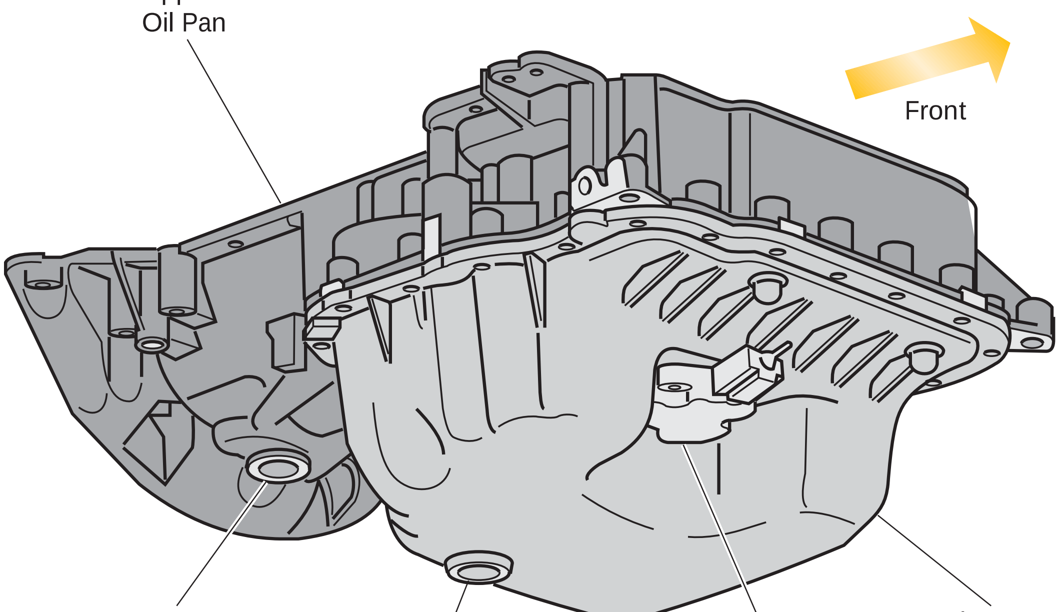
Both the upper and lower oil pans have their own drain plugs.



If the upper oil pan drain plug is not removed during the draining procedure, about 0.53 quart (0.50 liter) of engine oil will remain in the upper oil pan.

Engine Oil Level Sensor G12

The Engine Oil Level Sensor G12 functions as an information sender for the oil level warning display in the instrument cluster.



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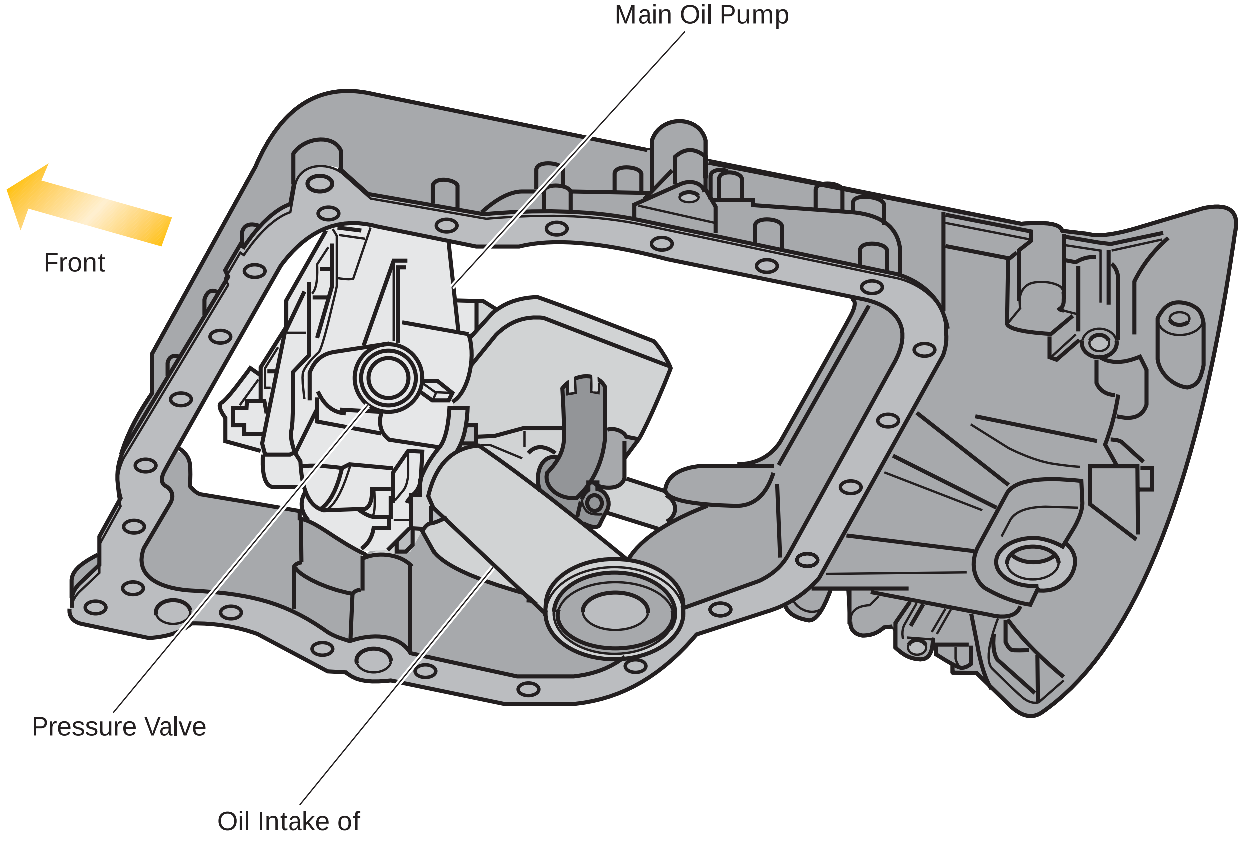
Touareg Oil Pump

The chain-driven duocentric oil pump is a two-stage pump assembly. It consists of a main oil pump combined with a purge pump with a drain stage.

Both pump gears are identical.

The main oil pump supplies the engine oil circuit with the necessary amount of oil for lubrication of the engine.

Viewed from Below



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Touareg purge pump function

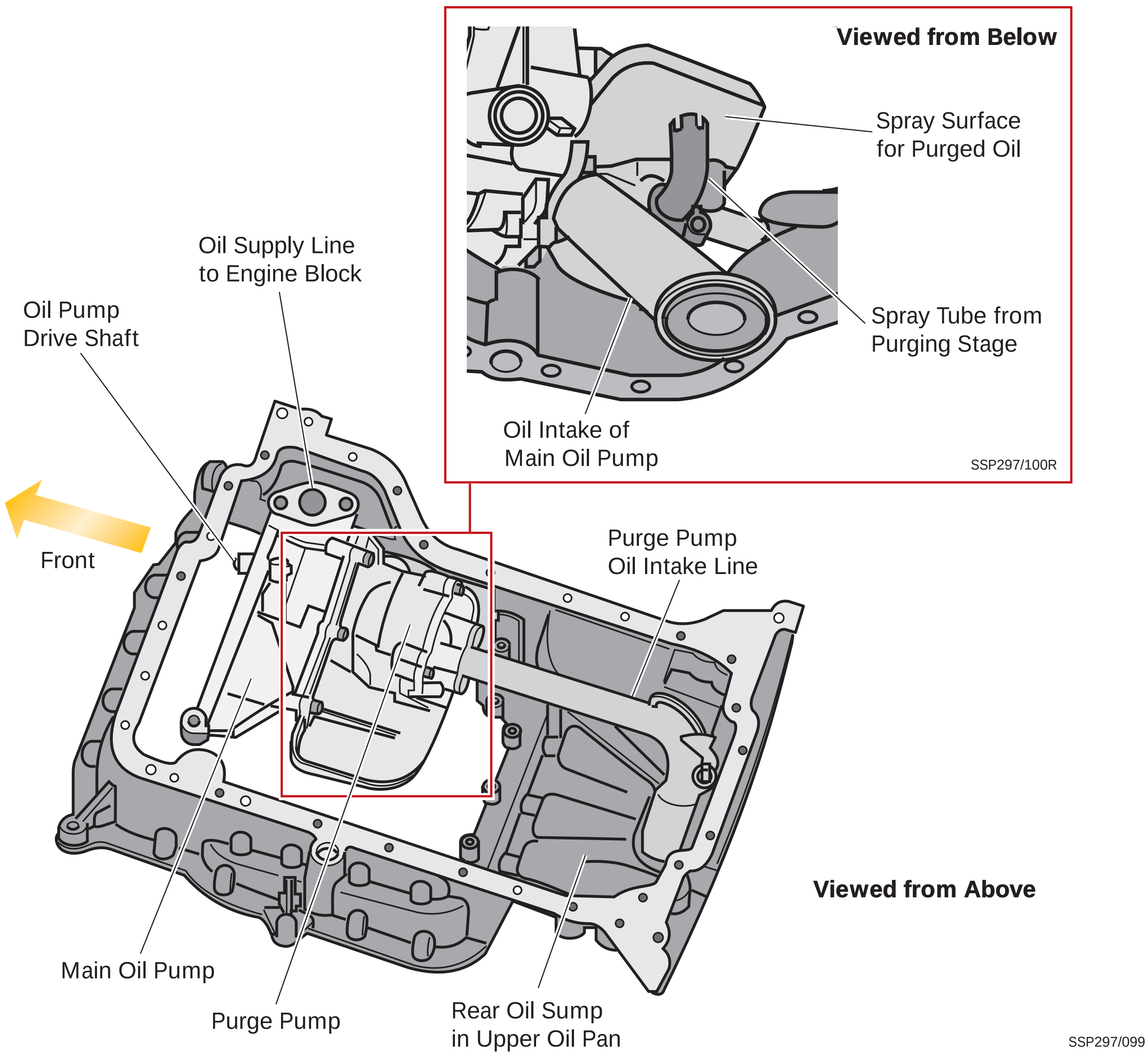
When the vehicle is driven up or down hill, the oil purge pump (purging stage) draws oil out of the rear sump in the upper oil pan through an intake line.

The oil purge pump then sprays the oil through a spray tube onto the surface of the oil pump housing.

The sprayed oil drips down into the main sump in the lower oil pan.

This assures a constant oil supply to the main oil pump when the vehicle is driven up or down hills.

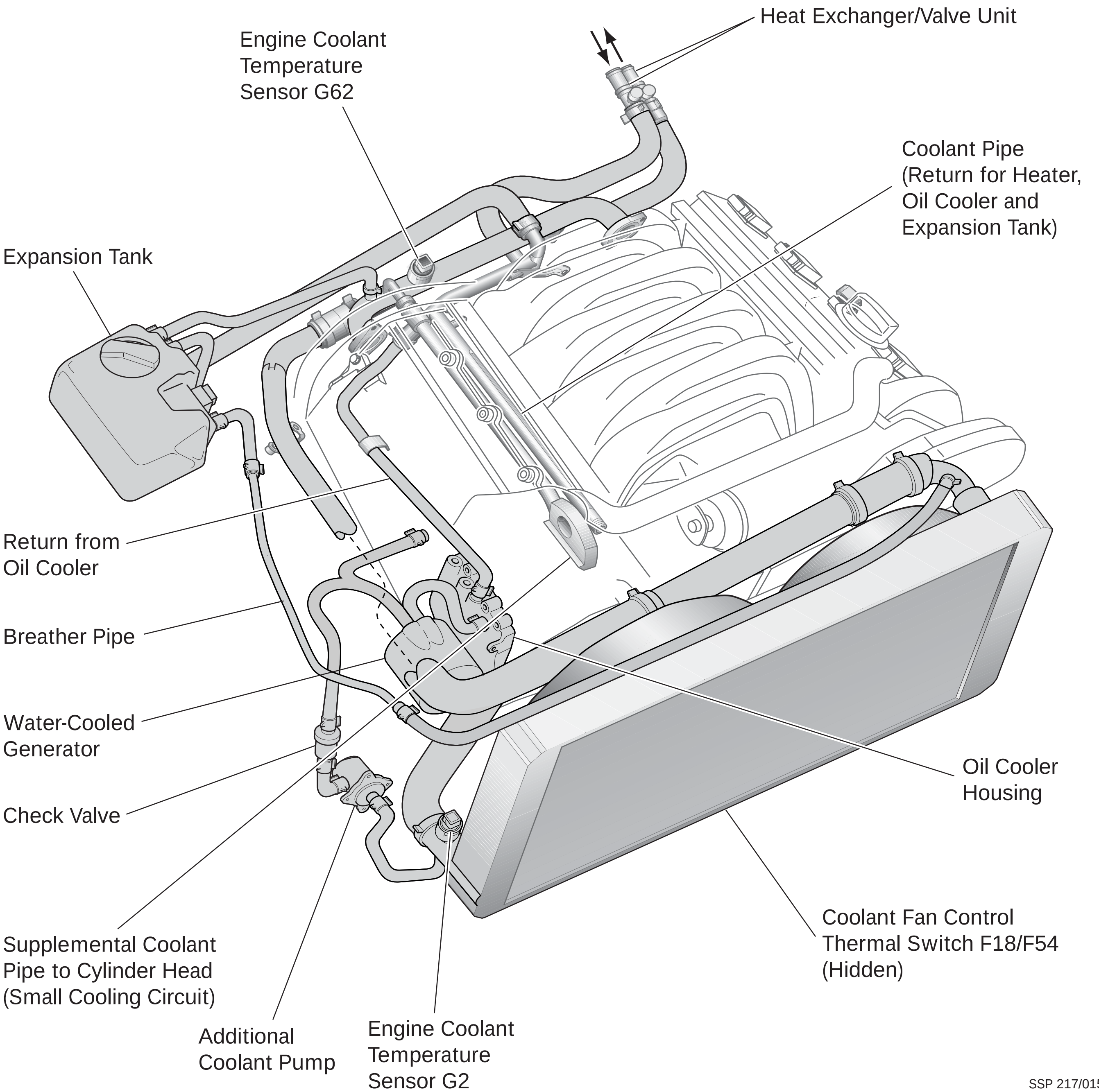
The main oil pump draws the oil in through the main oil intake and pumps it through the engine block supply line to feed the engine lubrication system.



Engine Cooling Circuit

The engine coolant flows from the rear of the cylinder heads into a common rear coolant pipe. From there coolant is routed to the radiator.

The flow direction of the coolant is similar to that of V6 engines.



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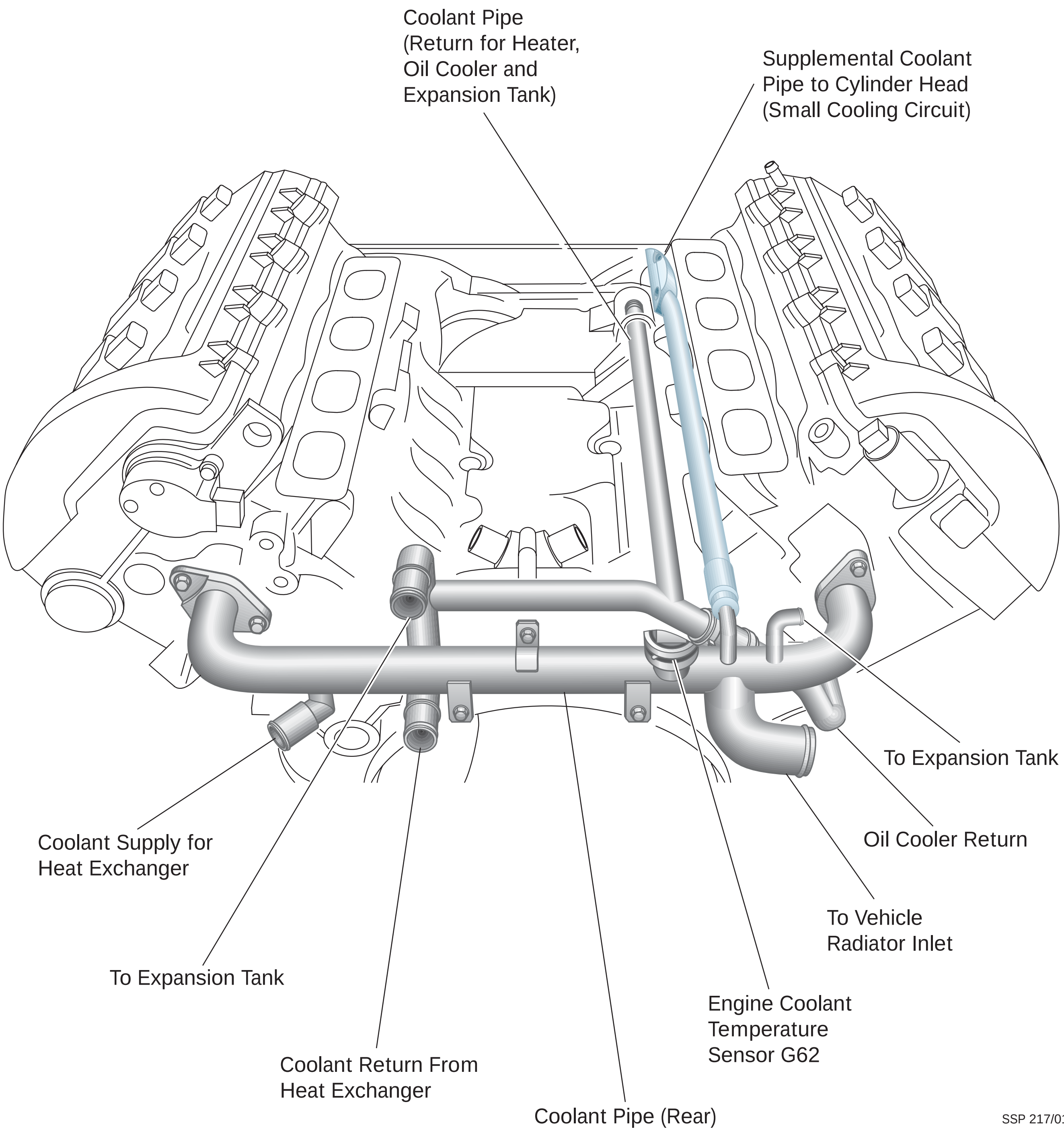
A supplemental coolant pipe to the cylinder head provides alternate coolant flow for the small cooling circuit.



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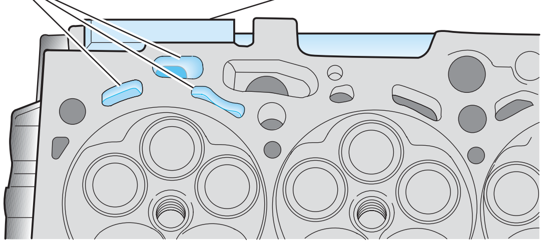

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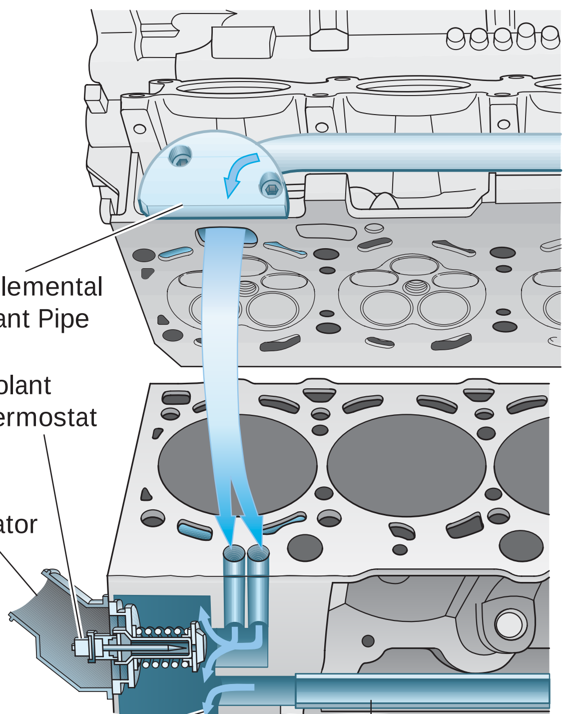


SSP 217/017

Coolant Flow in the Cylinder Head and Crankcase

The coolant passage connection in the cylinder head to the water jacket in the cylinder crankcase is split.

The coolant from the rear coolant pipe is divided by the supplemental coolant pipe to the cylinder head (mixture from all cylinders) and then passes through the cylinder head to the two holes which lead off to the coolant thermostat.

This ensures uniform temperature control.

The cylinder head connects the coolant pipe to the two holes leading off to the coolant thermostat.

Cylinder Head

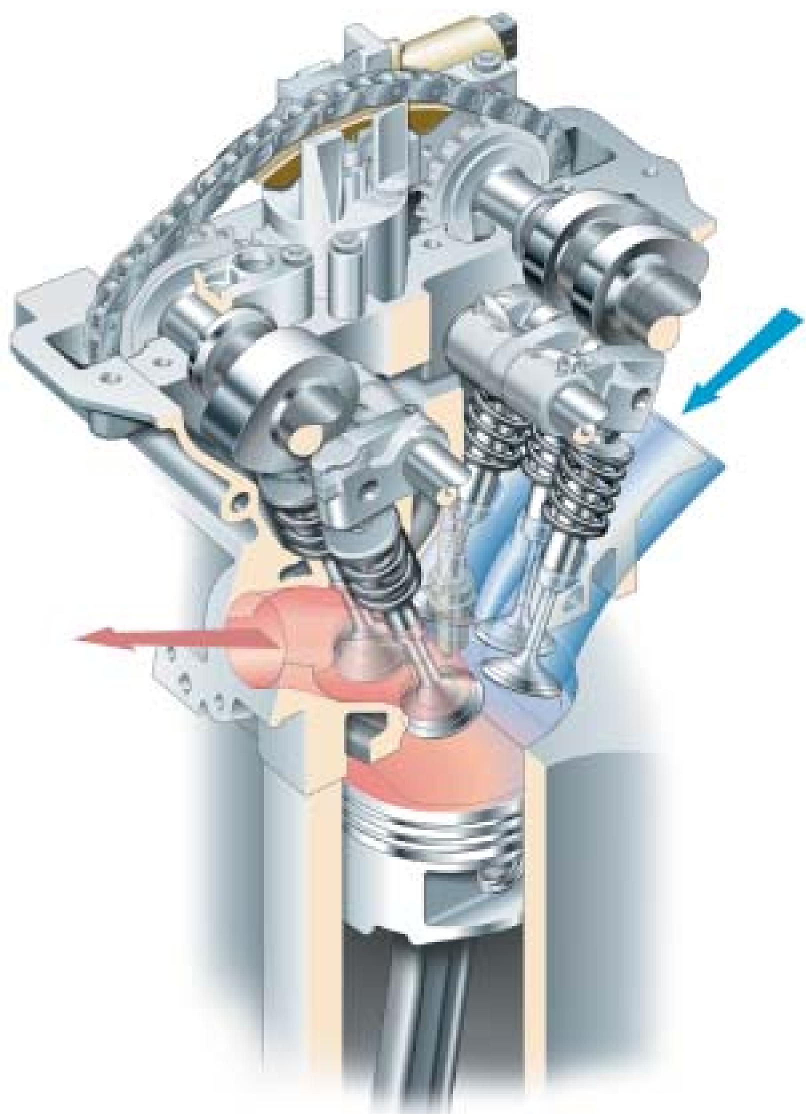
Five-Valve Technology

Five-valve technology is used in the 4.2-liter V8-5V engines.

Roller rockers are used in the enhanced five-valve cylinder head. This considerably reduces frictional losses in the valve train which, in turn, significantly improves efficiency.

The rockers are made of die-cast aluminum in order to keep inertia forces as low as possible. As a result, the valve train is able to function reliably at high rpm.

The use of roller rockers has not only meant a considerable reduction in frictional losses in the valve train, but has also halved the oil delivery rate in the cylinder heads. This also has a positive effect on the degree of efficiency.



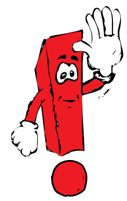
SSP 217/020

Exhaust Valve Roller Rockers

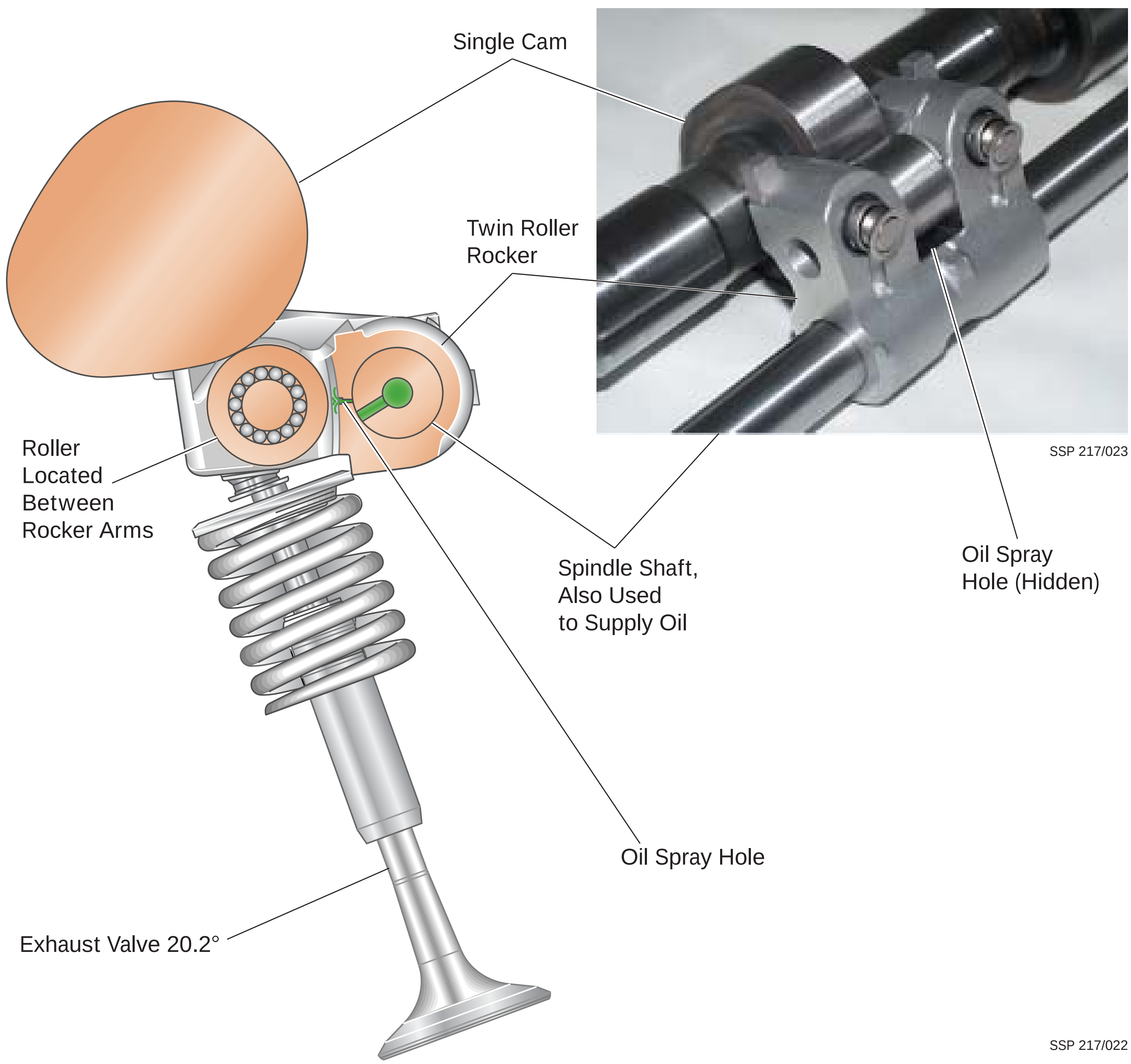
Every valve has a hydraulic valve lifter which is integrated in the rocker. The rockers are supported by a spindle shaft which is also used to supply oil to the bearings and the hydraulic valve lifters.

The two exhaust valves are actuated by a twin roller rocker.

The single cam actuates the rocker by means of a roller located between the rocker arms.



The individual hydraulic valve lifters can be replaced without removing the rockers.



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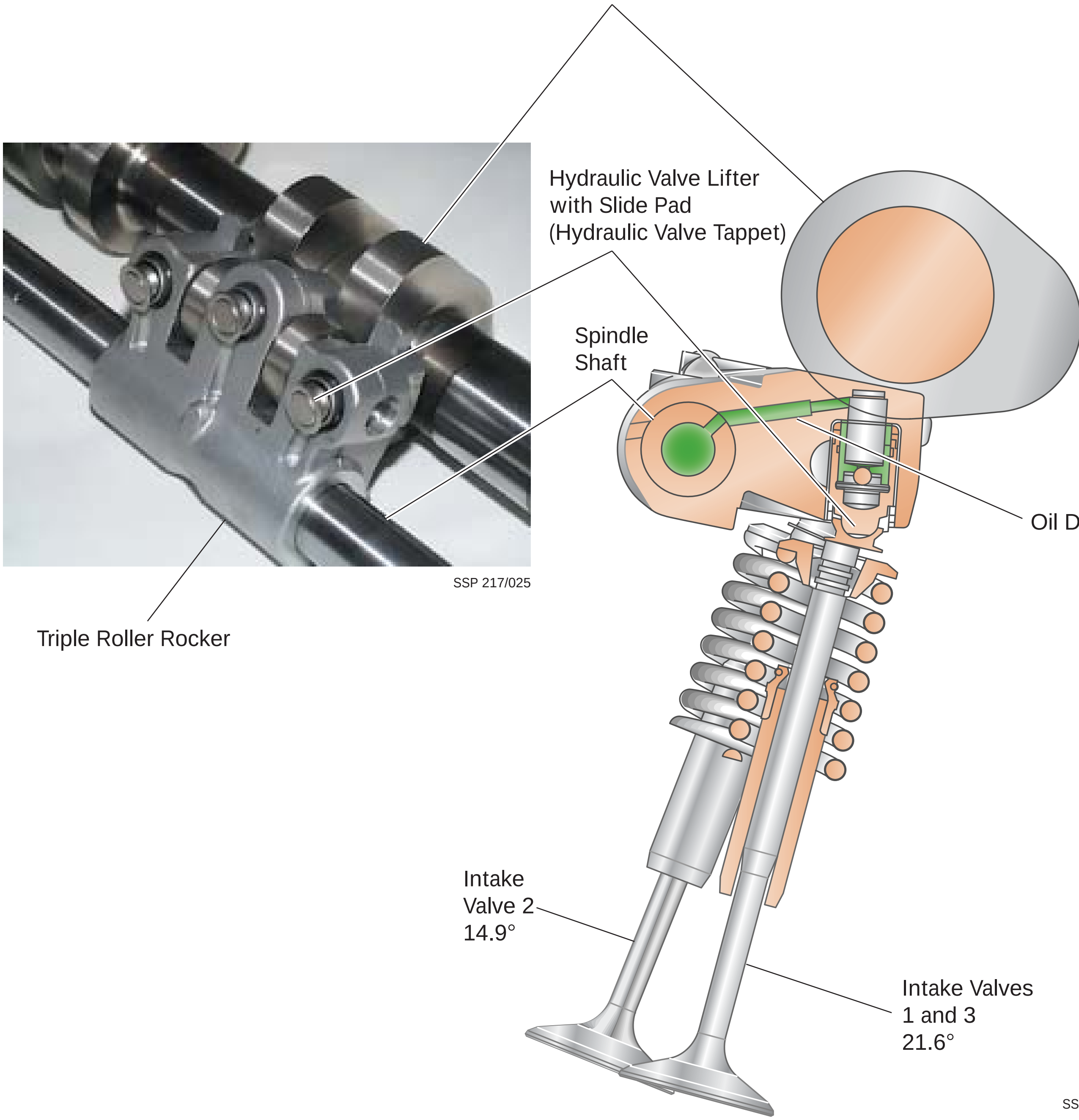
SSP 217/022

Intake Valve Roller Rockers

The three intake valves are actuated by a triple roller rocker.

A double cam actuates the rocker with two rollers between the rocker arms.



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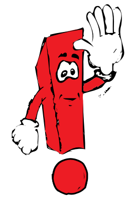
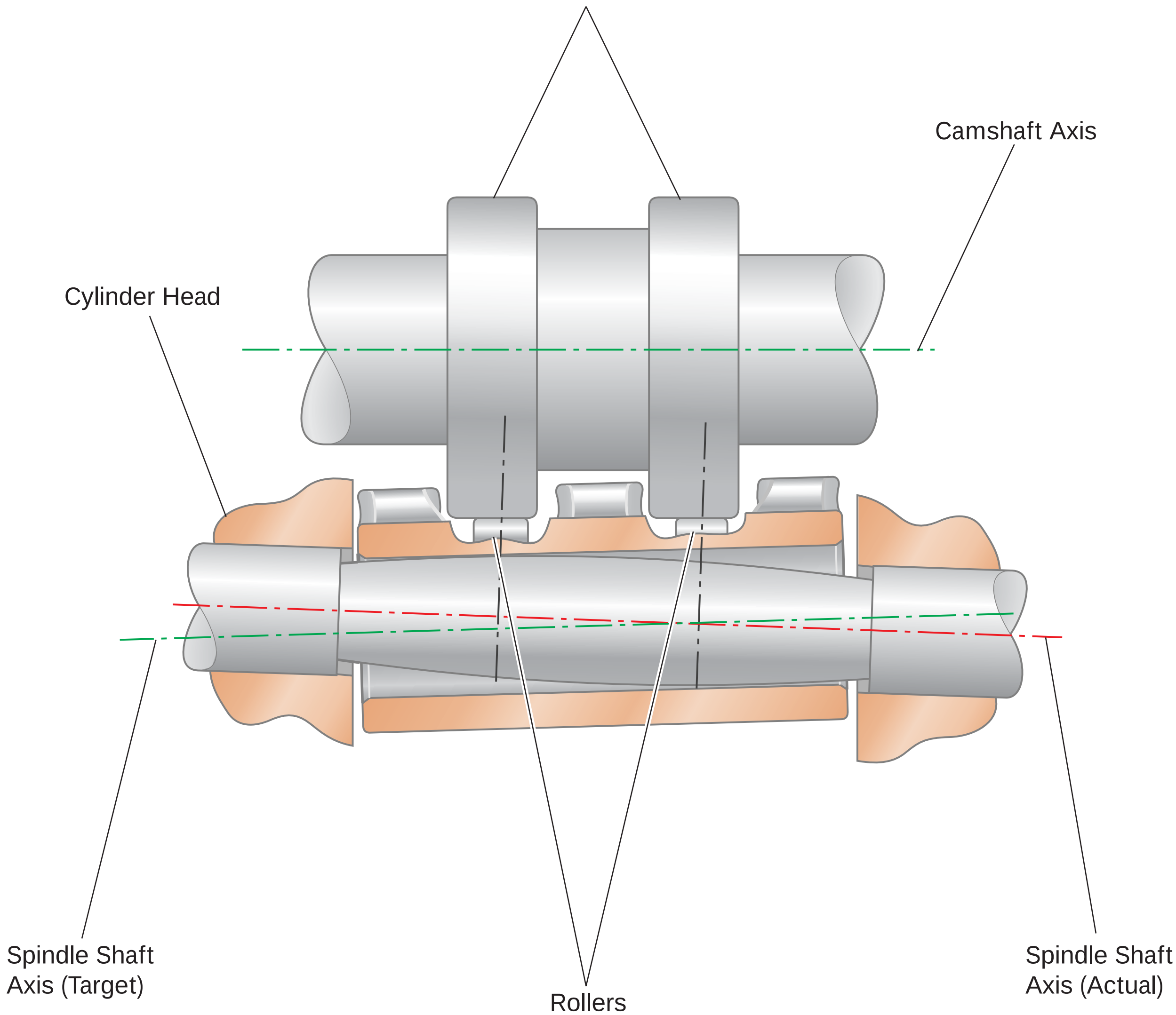
Tolerance Compensation for Intake Triple Roller Rocker

To ensure uniform compression between the two cams and rollers of the roller rockers, the spindle shaft of the intake roller rocker is convex in shape in order to compensate alignment and component tolerances.



For the sake of clarity, the tolerance of the spindle shaft relative to the camshaft has been greatly exaggerated in the illustration.



SSP 217/021

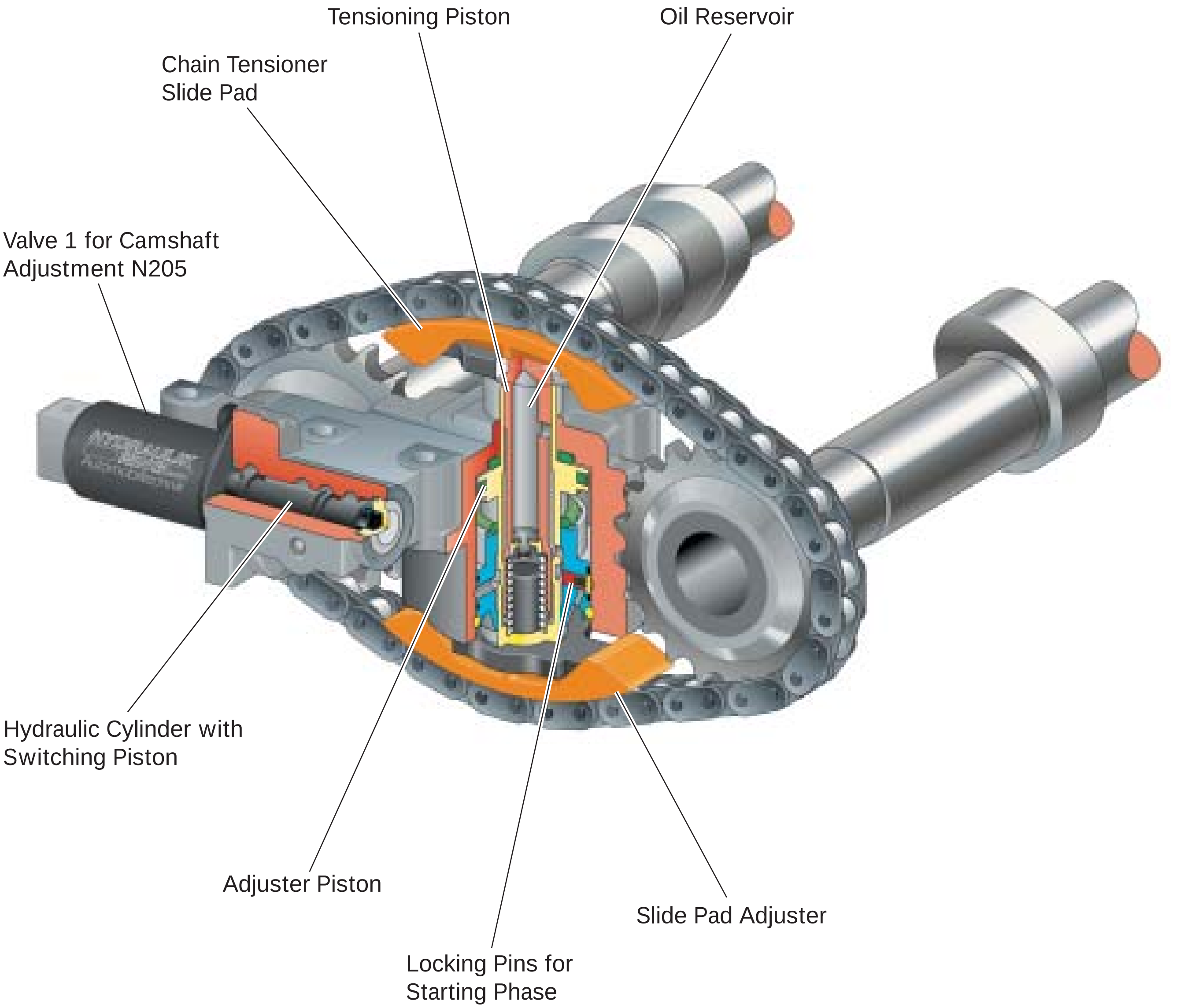
Camshaft Adjuster (Cylinder Bank 1)

The camshaft adjustment system, a feature of many Volkswagen engines, is also used in the 4.2-liter V8-5V engine.

When the engine is turned off, no oil pressure is applied to the chain tensioner and camshaft adjuster.

On the 4.2-liter V8-5V engines, an interlock function and an oil reservoir are a part of the system.

This prevents vibrations in the chain drive that could cause noise during the start phase.



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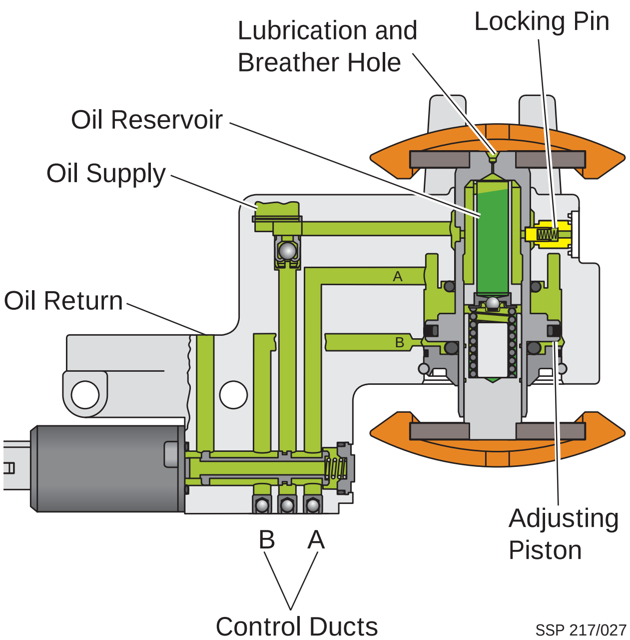

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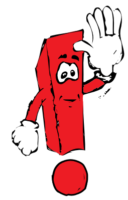
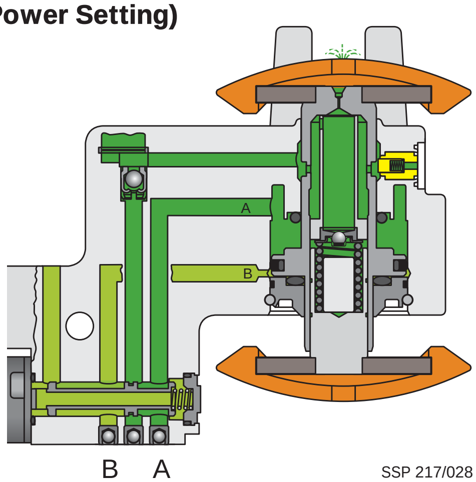


In the following illustrations, cylinder bank 1 is shown. Cylinder bank 2 works the same way.

Engine Off

If there is no oil pressure, a spring-loaded locking pin is pushed into the detent slot of the adjusting piston. The adjusting piston is then locked.

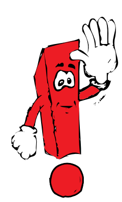
Retard Setting
(Basic and Power Setting)



SSP 217/028

Engine Start

The adjusting piston is locked until sufficient oil pressure has built up. This prevents vibrations in the chain drive and, therefore, noise generation.



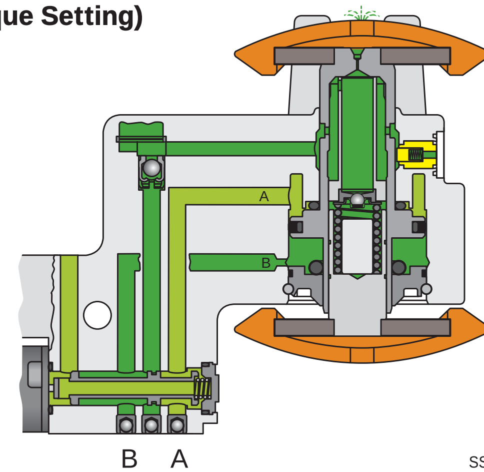
The camshaft adjuster is locked in the “retard“ position.

Engine Running

Once a defined oil pressure has been reached, it acts on the surface of the locking pin, against the resistance of the spring.

The locking pin releases the adjusting piston so that the engine control module can adjust the timing in the "advance" direction.

Advance Setting (Torque Setting)



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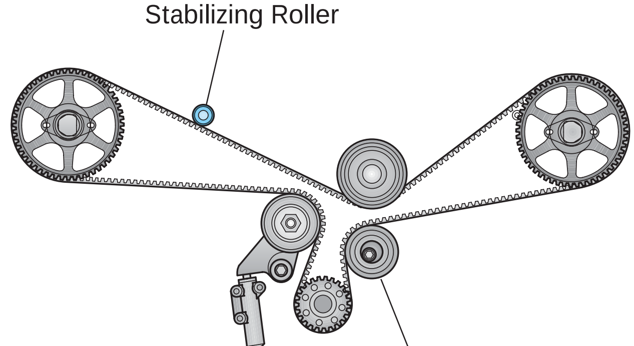
Oil Reservoir

The oil reservoir ensures that the pressure chamber of the tensioner piston is filled during the non-pressurized phase of the starting cycle. This also reduces noise when the engine is started.

A hole in the top of the oil reservoir allows air to escape and supplies the chain with oil.

Toothed-Belt Drive

The 4.2-liter V8-5V engine toothed-belt drive is nearly identical to that of the V6-5V engine. The V8-5V engine has a stabilizing roller.



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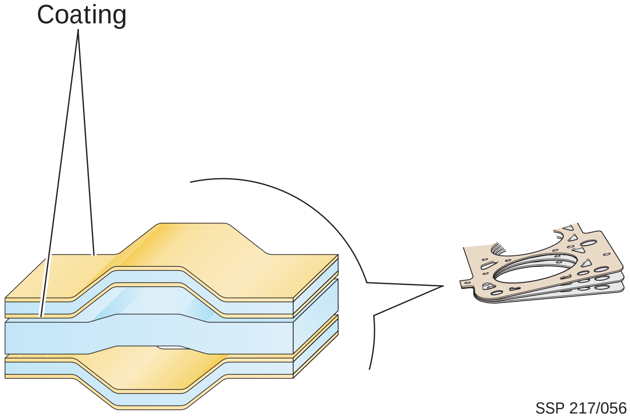


SSP 217/056

Cylinder Head Gasket

The 4.2-liter V8-5V engine has a multi-layer metallic cylinder head gasket like those used in the 4- and 6-cylinder engines.

The multi-layer gasket is comprised of three individual metallic layers.

The two outermost layers are treated with a special coating.

This design has the following advantages:

- Very good settling behavior.
- Improved durability.

Cylinder Head Cover Seal

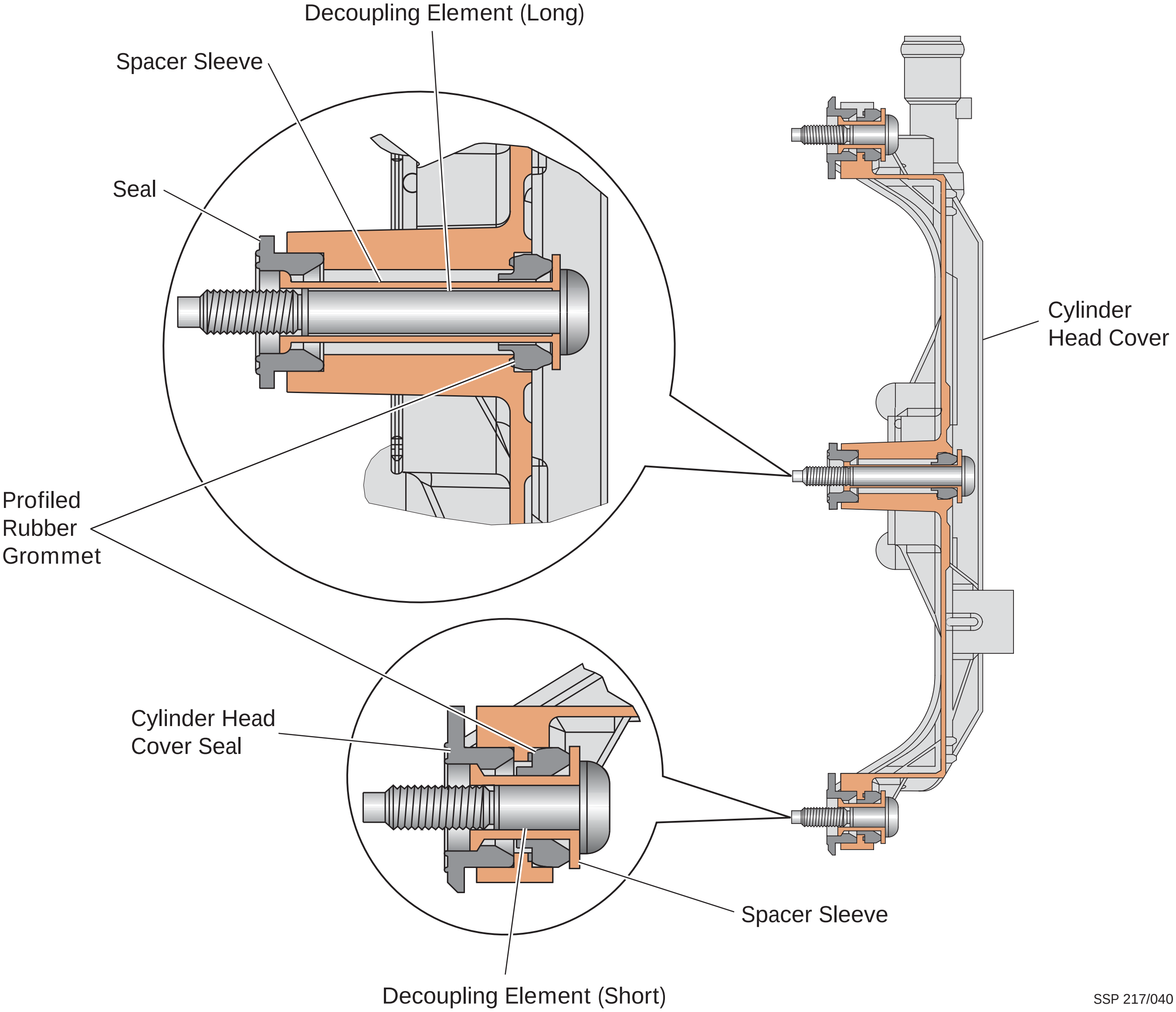
The thin-wall cylinder head covers are made of a die-cast magnesium alloy. A seal system that isolates the cylinder head cover from the cylinder head reduces engine noise.

The bolted connections of the cylinder head cover have decoupling elements.

A seal, which is similar to a radial shaft oil seal, is used for the spark plug shaft.

These techniques result in the cylinder head cover not being directly coupled with the cylinder head. It is, therefore, “insulated“ against vibrations generated by the engine.

Cylinder Head Cover



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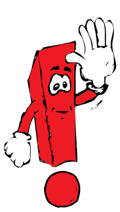
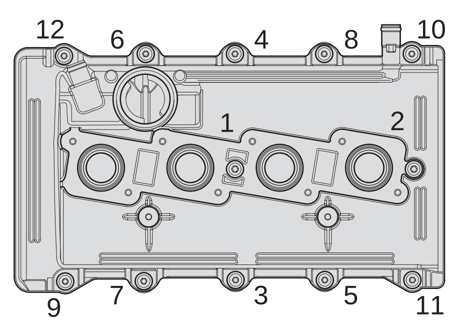


The securing bolts must be tightened uniformly in the specified order. This prevents distortion of the cylinder head cover and ensures that the seal is completely air tight.
It also helps prevent oil leaks.

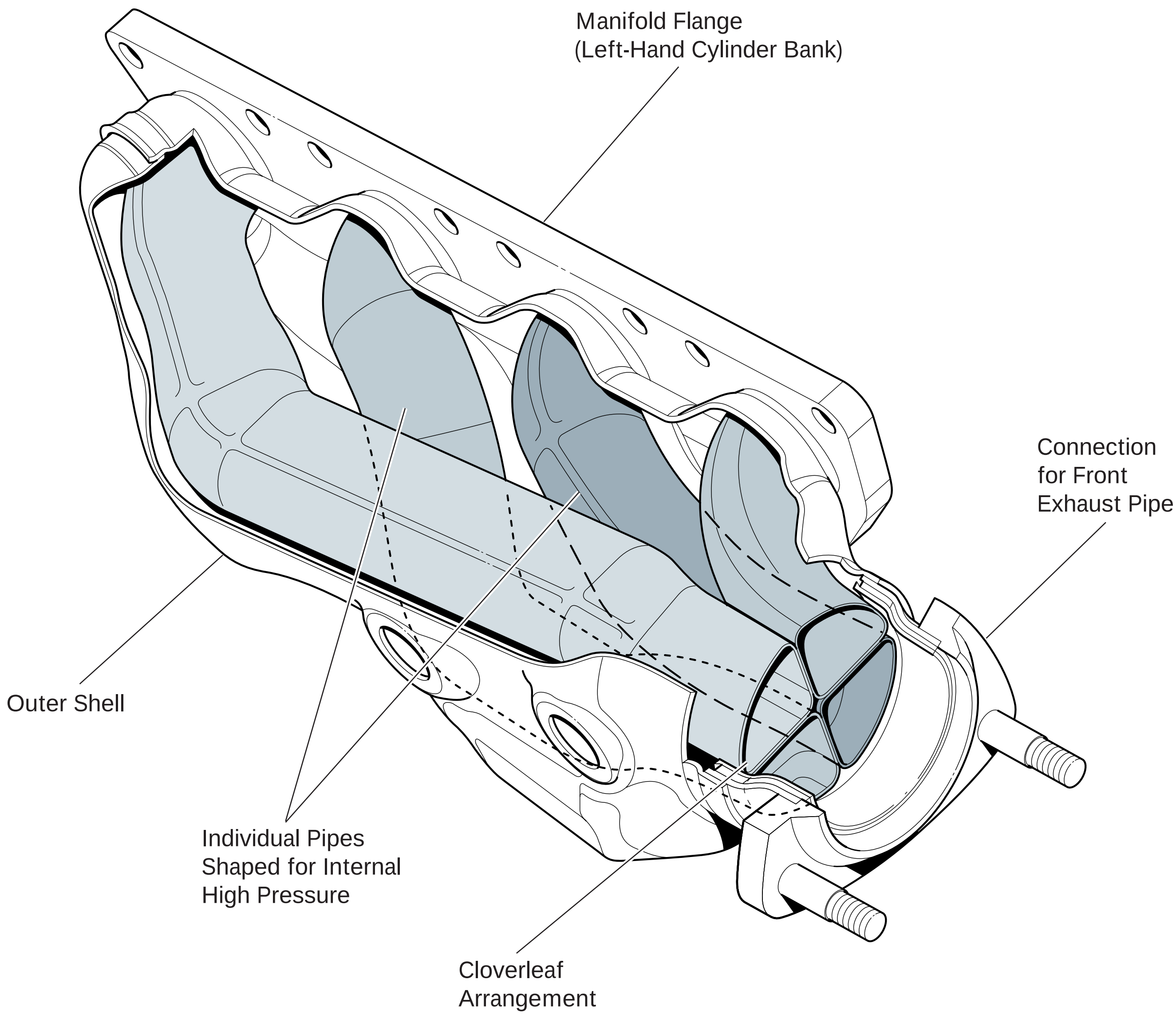


SSP 217/043

Exhaust Manifold

The exhaust pipes of the individual cylinders are assembled in a cloverleaf configuration for each cylinder bank (four-in-one arrangement).

This effectively protects the individual cylinders against annoying exhaust vibrations which, in turn, has a positive effect on engine torque characteristics.



SSP 217/036

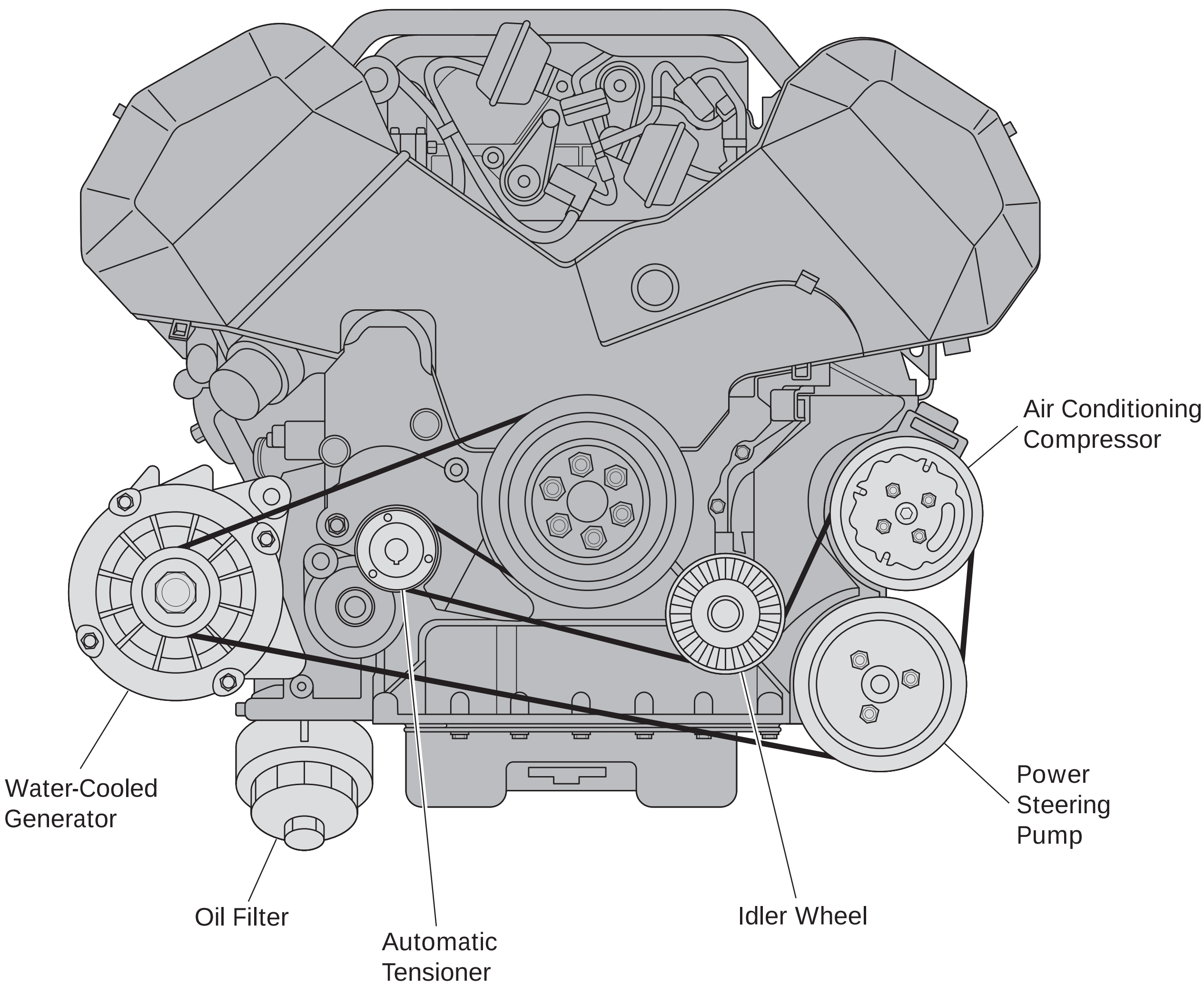
Accessory Belt Drive

To accommodate the water fording capability of the Touareg, the accessory belt drive for the 4.2-liter V8-5V engine is designed for optimal position of the accessories.

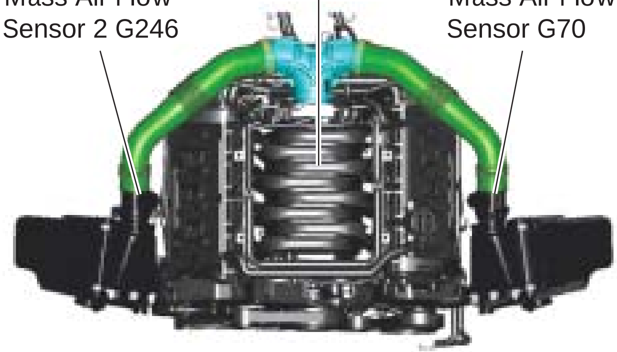
The air conditioning compressor is mounted above the power steering pump.

The 190-ampere water-cooled generator is mounted high.

A single poly-V-ribbed belt drives all the belt-driven accessories. Drive belt tension is maintained with an idler wheel on one side and a mechanically damped automatic tensioner on the other.



Engine – Variable Intake Manifold



SSP217/105

Air Intake

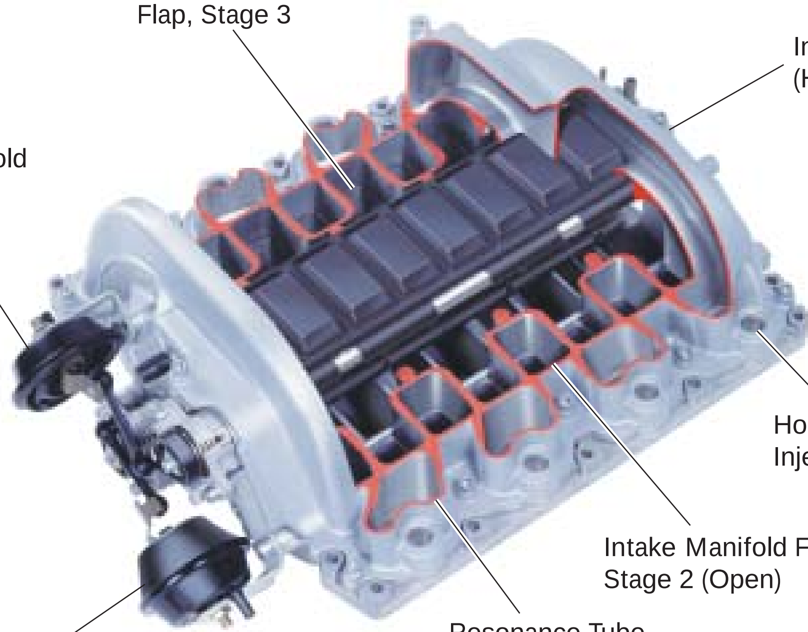
The 4.2-liter V8-5V engine uses a dual air intake system to feed the three-stage variable intake manifold.

This system includes air intake through two air cleaners with two hot film air mass meters, one mounted downstream of each air cleaner on either side of the engine:

- Mass Air Flow Sensor G70
- Mass Air Flow Sensor 2 G246

Intake Manifold Module

Increasing torque by means of variable intake manifolds is a Volkswagen tradition. A three-stage variable intake manifold made of a die-cast magnesium alloy, a further development of previous concepts, is being used.



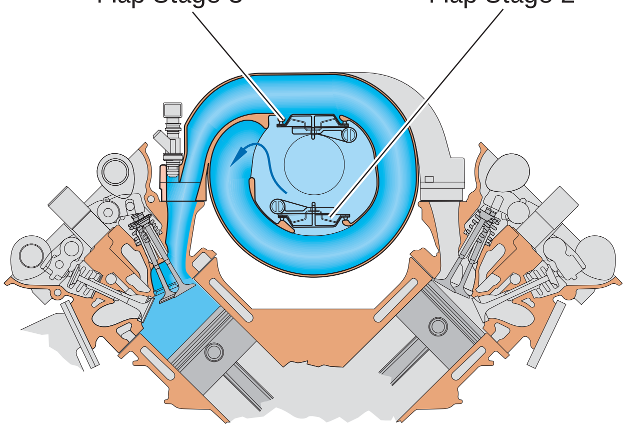
SSP 217/031

The variable intake manifold consists of four principal housing components which are bonded and bolted together.

The concept uses two intake manifold flaps to produce three different intake manifold lengths (“resonance tube lengths“).
To utilize the pulsations to optimum effect, the intake manifold flaps close the resonance tube openings by means of a molded-on sealing lip.

The variable intake manifold must not be dismantled. If necessary, the entire assembly must be replaced as a unit.

SSP 217/030



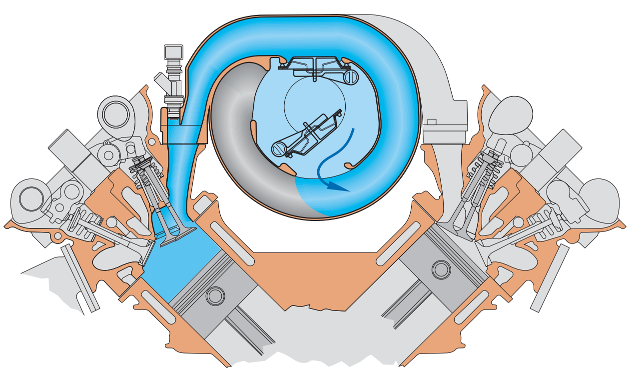
SSP 217/032

Operating Stages

Stage 1
Lower Speed Range

When the engine is turned off, both flaps are open.

If the engine is idling, the two vacuum units are evacuated by the appropriate intake manifold changeover solenoid valves. The intake manifold flaps are, therefore, closed between the idling speed and the switching speed.

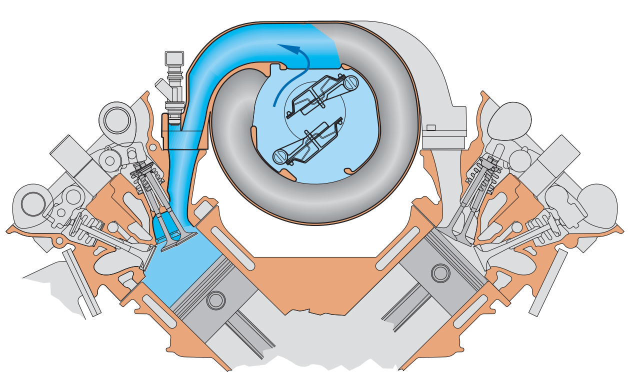


SSP 217/033

Stage 2
Middle Speed Range

In the middle speed range, the Intake Manifold Changeover Valve N156 allows atmospheric pressure into the vacuum unit of the stage 3 intake manifold flap.

The stage 2 intake manifold flap is opened and the intake path is shortened.



SSP 217/034

Stage 3
Upper Speed Range

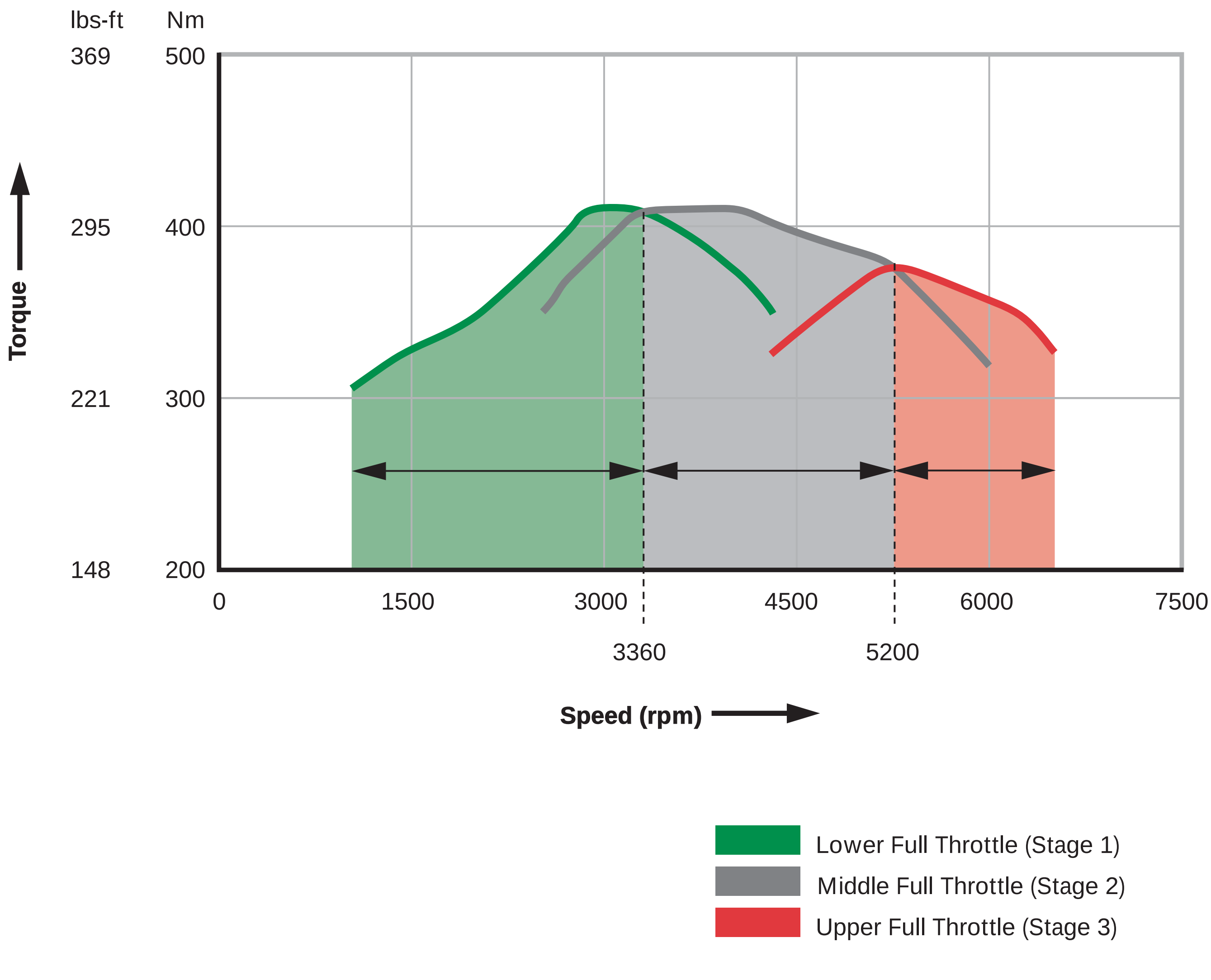
In the upper speed range, the stage 3 intake manifold flap is also opened. The intake air takes the shortest path to the combustion chamber.

Effect of Variable Intake Manifold on Torque

Since the maximum torque across the speed range depends primarily on the length and cross section of the intake manifold, the new three-stage variable intake manifold comes closest to producing the optimum characteristic torque curve across the speed range.

Depending on the engine speed, appropriate “resonance tube lengths“ are available for the lower, middle and upper speed ranges.

The illustration explains the correlation between the length/cross section of the intake manifold and engine speed and shows the characteristic torque curve produced by the three stages.



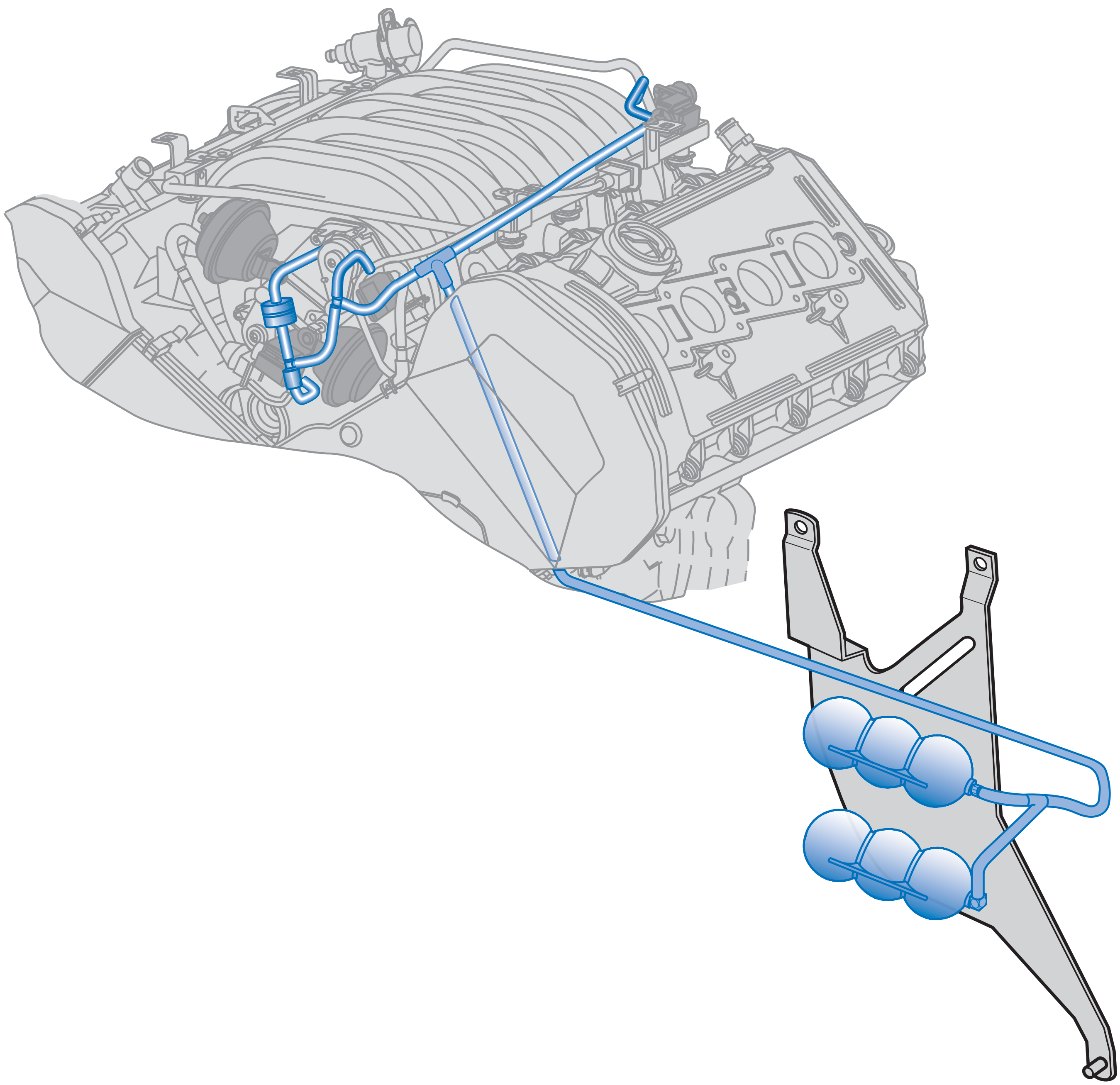
SSP 217/035

Engine – Variable Intake Manifold

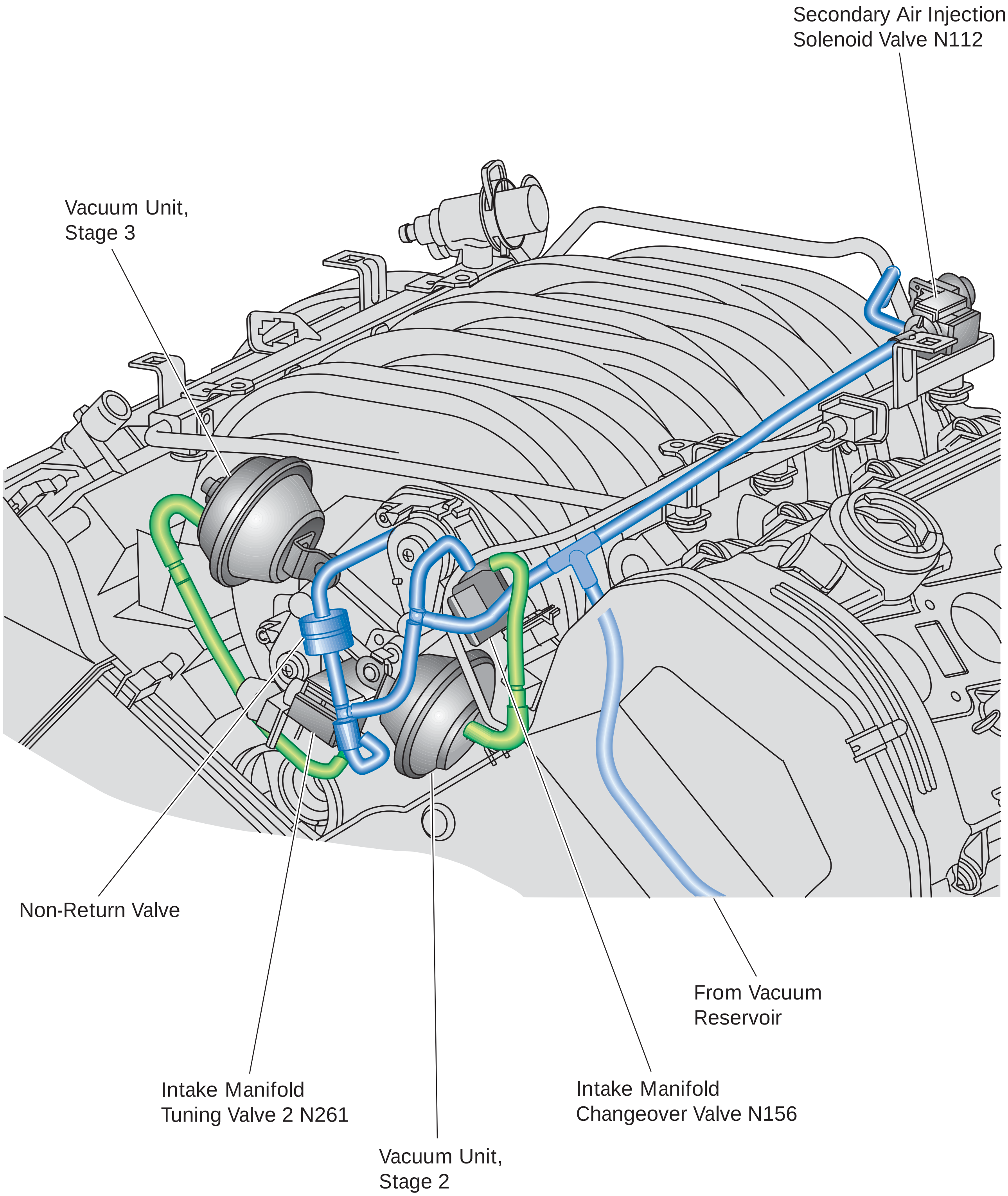
Vacuum Reservoirs

The vacuum required to control the variable intake manifold and the secondary air system is provided by vacuum reservoirs located beneath the left front headlight.

If a vacuum exists in the intake manifold, the reservoirs are evacuated via a non-return valve.



SSP 217/ 051


Secondary Air Injection
Solenoid Valve N112
Vacuum Unit,
Stage 3
Non-Return Valve
From Vacuum
Reservoir
Intake Manifold
Tuning Valve 2 N261
Intake Manifold
Changeover Valve N156
Vacuum Unit,
Stage 2

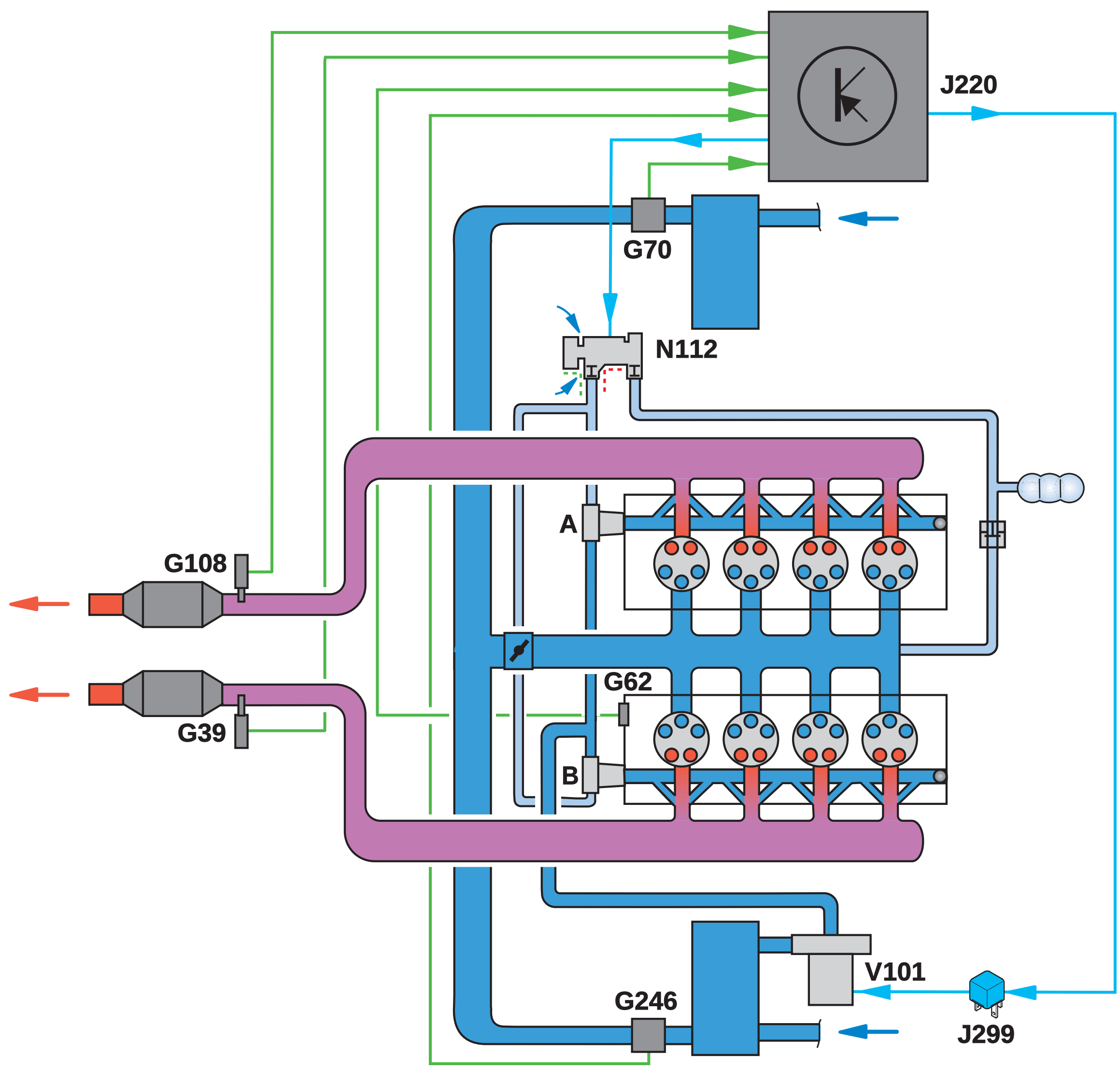
SSP 217/052

Secondary Air System Overview

Because of high mixture enrichment during the cold-start and warm-up phase, an increased proportion of unburned hydrocarbons exists in the exhaust gas during this time.

The catalytic converter cannot process this high proportion of hydrocarbons because:

- The required operating temperature of the catalytic converter has not yet been reached.
- A stoichiometric mixture (14.7 : 1 air-fuel ratio) must exist to allow complete conversion.

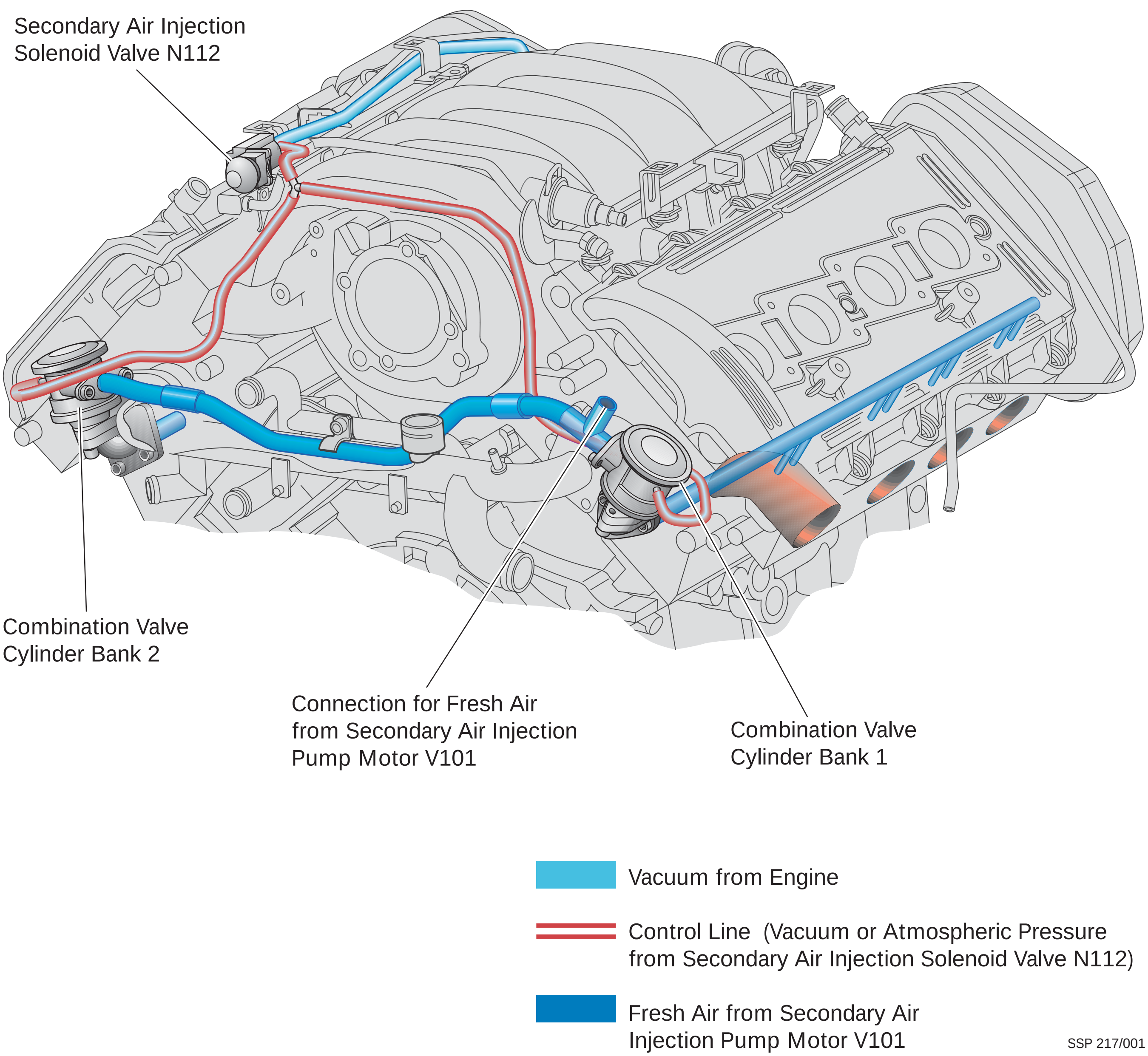


SSP 217/ 042

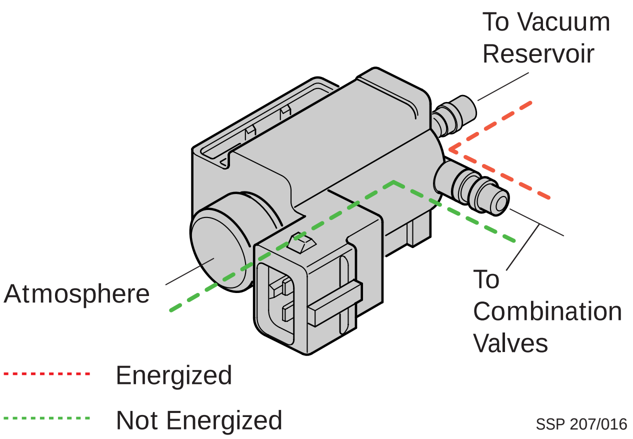
Air injection downstream of the outlet valves causes oxygen enrichment of the exhaust gases. As a result, the hydrocarbons and the carbon monoxide undergo post-oxidation (afterburning). The thermal energy released during this process also heats up the catalytic converter so that it reaches its operating temperature more quickly.

The secondary air system consists of:

- Secondary Air Injection Pump Motor V101
- Two combination valves A and B for cylinder banks 1 and 2
- The Secondary Air Injection Solenoid Valve N112



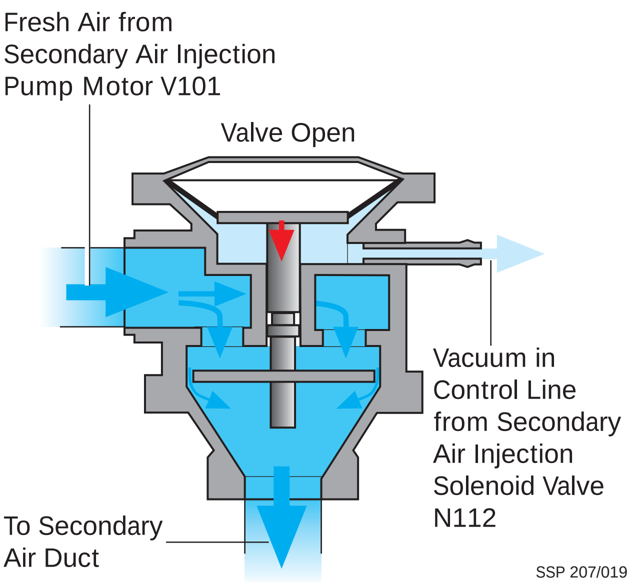
SSP 217/001



Component Function

Secondary Air Injection Solenoid Valve N112

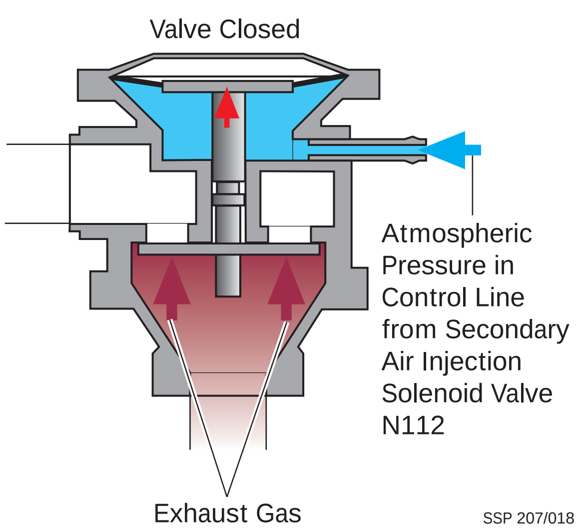
The Secondary Air Injection Solenoid Valve N112 is an electro-pneumatic valve. It is activated by the Motronic Engine Control Module J220 and controls the combination valve. It releases the vacuum stored in the reservoir to open the combination valve. Atmospheric pressure is released to close the combination valve.



Combination Valve

The combination valve is bolted to the secondary air duct of the cylinder head.

The vacuum from the Secondary Air Injection Solenoid Valve N112 causes the air channel between the Secondary Air Injection Pump Motor V101 and the secondary duct of the cylinder head to open.



When closed, the valve prevents hot exhaust gases from entering and then damaging the Secondary Air Injection Pump Motor V101.

Secondary Air Injection Pump Motor V101

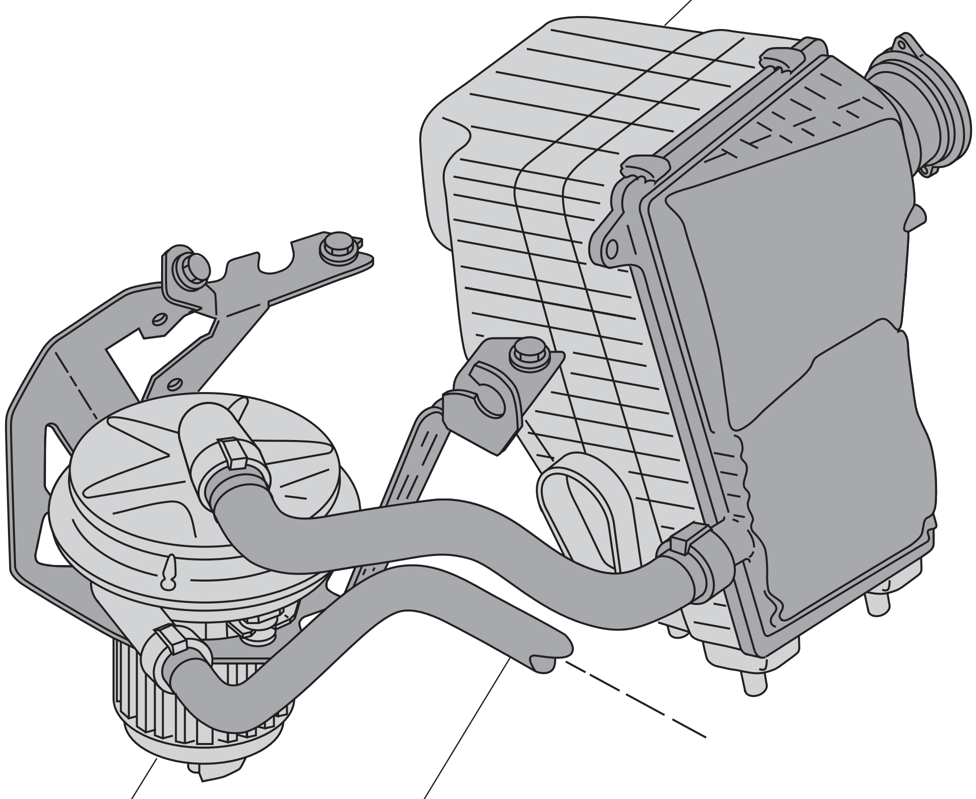
The Secondary Air Injection Pump Relay J299 activated by the Motronic Engine Control Module J220 connects the power supply for the Secondary Air Injection Pump Motor V101. The fresh air is drawn from the air filter housing by the Secondary Air Injection Pump Motor V101 and released by the combination valve.

The secondary air system is active at coolant temperatures between 32°F and 131°F (0°C and 55°C).

The Secondary Air Injection Pump Relay J299 and the Secondary Air Injection Solenoid Valve N112 are activated simultaneously.

The system is turned off after a defined air mass has been drawn in by the engine (information from the two mass air flow sensors). At idling speed, this occurs after approximately 60 to 90 seconds.

The Touareg configuration is shown.



SSP/217/049

Engine Management

Motronic ME 7.1.1 System Overview

Sensors

Mass Air Flow Sensor G70

Mass Air Flow Sensor 2 G246

Engine Speed Sensor G28

Camshaft Position Sensor G40 (Bank 2)
Camshaft Position Sensor 2 G163 (Bank 1)

Heated Oxygen Sensors G39 and G108;
G130 and G131

Throttle Valve Control Module J338 with Angle Sensors (1) G187 and (2) G188 for Throttle Valve Drive (Power Accelerator Actuation) G186

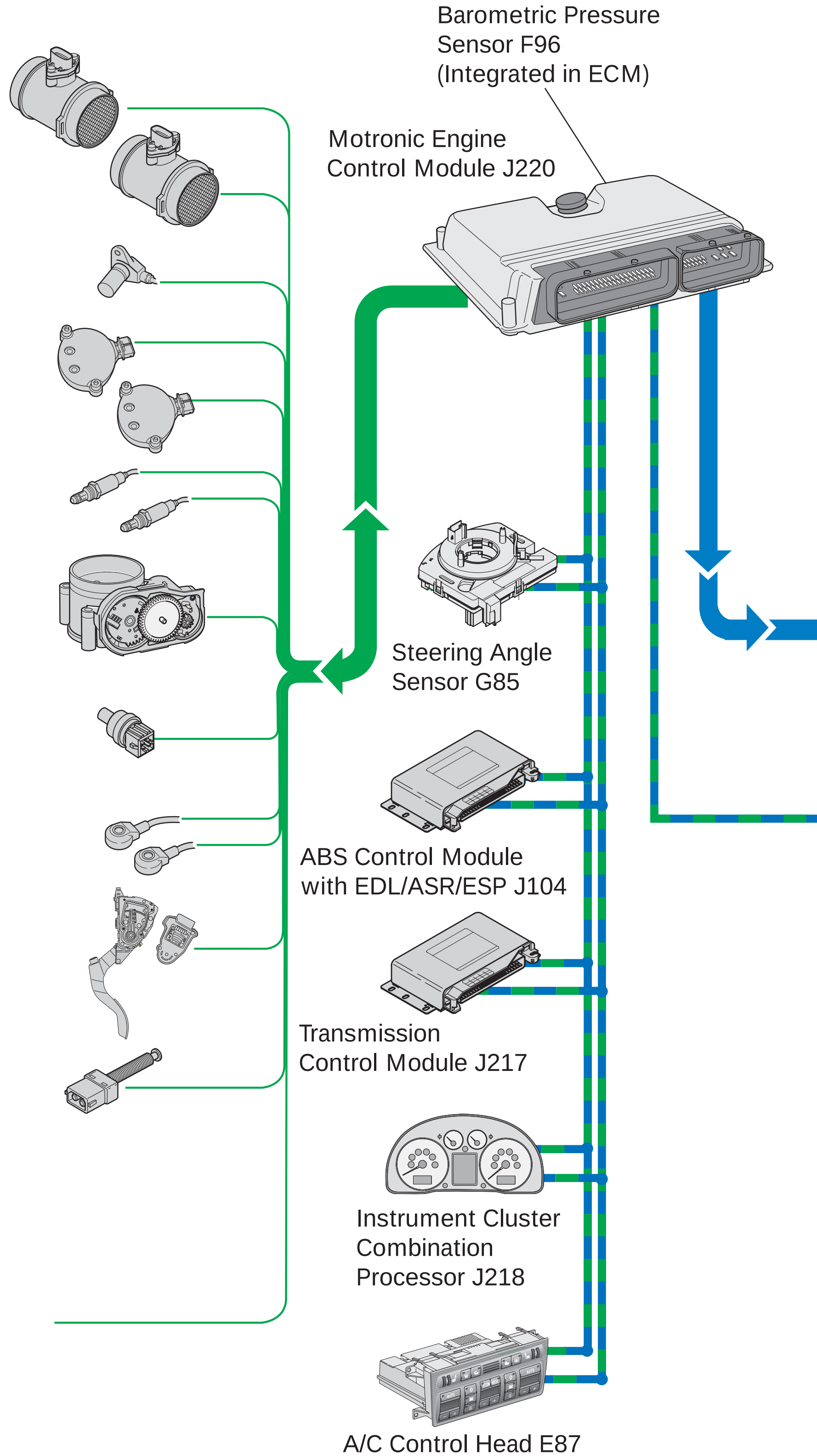
Engine Coolant Temperature Sensors G2 and G62

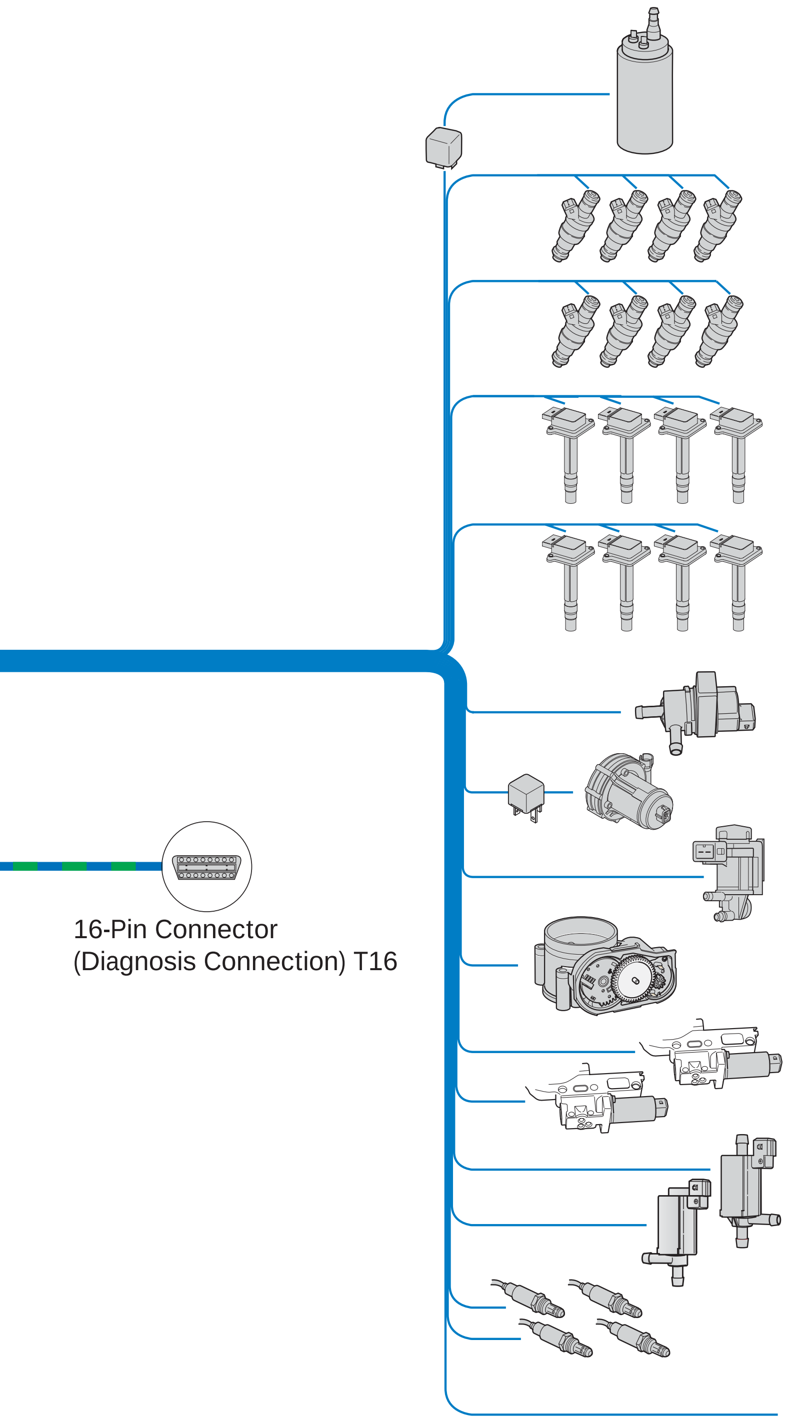
Knock Sensors (Bank 1) G61 and (Bank 2) G66

Sender -1- for Accelerator Pedal Position G79 and
Sender -2- for Accelerator Pedal Position G185

Brake Light Switch F and Brake Pedal Switch F47

Additional Signals
- Air Conditioner Requirement Signal
- Air Conditioner Compressor, Bidirectional
- Crash Signal
- Cruise Control Switch E45
- LDP Vacuum Switch
- Vehicle Speed Sensor Signal





Actuators

Fuel Pump Relay J17 and Fuel Pump G6

Fuel Injectors (Bank 1) N30, N31, N32, N33

Fuel Injectors (Bank 2) N83, N84, N85, N86

Ignition Coils N (Cyl. 1), N128 (Cyl. 2), N158 (Cyl. 3), N163 (Cyl. 4)

Ignition Coils N164 (Cyl. 5), N189 (Cyl. 6), N190 (Cyl. 7), N191 (Cyl. 8)

EVAP Cansiter Purge Regulator Valve N80

Secondary Air Injection Pump Relay J299 and Secondary Air Injection Pump Motor V101

Secondary Air Injection Solenoid Valve N112

Throttle Valve Control Module J338 with Throttle Drive (Power Accelerator Actuation) G186

Valves for Camshaft Adjustment (Bank 1) N205 and (Bank 2) N208

Intake Manifold Changeover Valve N156

Intake Manifold Tuning Valve N261

Oxygen Sensor Heaters Z19 and Z28; Z29 and Z30

Additional Signals
- Air Conditioner Compressor (Out)
- LDP Reed Switch

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Functional Diagram — Motronic ME 7.1.1

Components

A Battery

D Ignition/Starter Switch

E45 Cruise Control Switch

F Brake Light Switch
F47 Brake Pedal Switch (For Cruise Control System)

G2 Engine Coolant Temperature Sensor
G3 Engine Coolant Temperature Gauge
G6 Fuel Pump
G28 Engine Speed Sensor
G39 Heated Oxygen Sensor
G40 Camshaft Position Sensor
G61 Knock Sensor 1
G62 Engine Coolant Temperature Sensor
G66 Knock Sensor 2
G70 Mass Air Flow Sensor
G79 Sender -1- for Accelerator Pedal Position
G108 Heated Oxygen Sensor 2
G130 Oxygen Sensor, Behind Three Way Catalytic Converter
G131 Oxygen Sensor 2, Behind Three Way Catalytic Converter
G163 Camshaft Position Sensor 2
G185 Sender -2- for Accelerator Pedal Position
G186 Throttle Drive (Power Accelerator Actuation)
G187 Angle Sensor -1- for Throttle Drive (Power Acclerator Actuation)
G188 Angle Sensor -2- for Throttle Drive (Power Acclerator Actuation)
G246 Mass Air Flow Sensor 2

J17 Fuel Pump Relay
J220 Motronic Engine Control Module
J299 Secondary Air Injection Pump Relay

M9 Left Brake Light
M10 Right Brake Light

N Ignition Coil
N30 Cylinder 1 Fuel Injector
N31 Cylinder 2 Fuel Injector
N32 Cylinder 3 Fuel Injector
N33 Cylinder 4 Fuel Injector
N80 Evaporative Emissions Canister Purge Regulator Valve
N83 Cylinder 5 Fuel Injector
N84 Cylinder 6 Fuel Injector
N85 Cylinder 7 Fuel Injector
N86 Cylinder 8 Fuel Injector
N112 Secondary Air Injection Solenoid Valve
N128 Ignition Coil 2
N156 Intake Manifold Change-Over Valve
N158 Ignition Coil 3
N163 Ignition Coil 4
N164 Ignition Coil 5
N189 Ignition Coil 6
N190 Ignition Coil 7
N191 Ignition Coil 8
N205 Valve 1 for Camshaft Adjustment
N208 Valve 2 for Camshaft Adjustment
N261 Intake Manifold Changeover Valve 2

P Spark Plug Connector

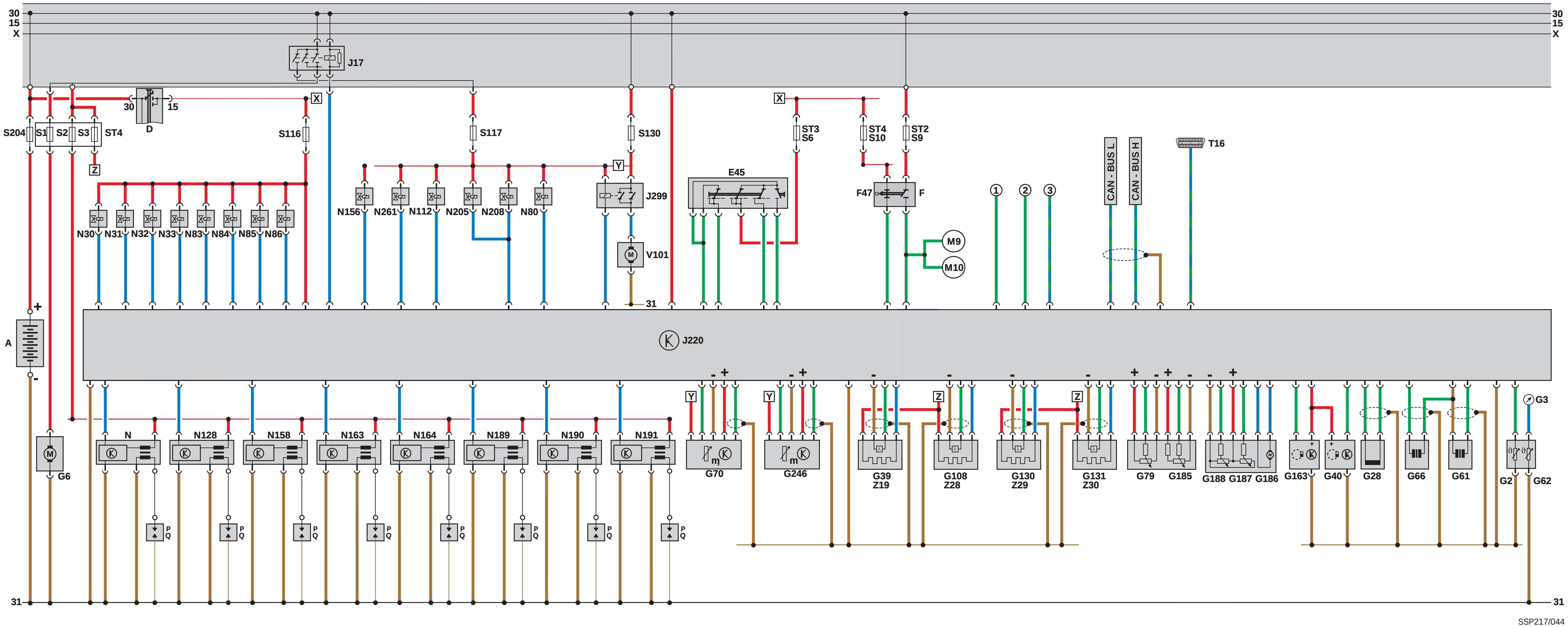
Q Spark Plugs

S Fuse
ST Fuse Holder
S204 Fuse 1 (30)

T16 16-Pin Connector (Diagnostic Connection)

V101 Secondary Air Injection Pump Motor

Z19 Oxygen Sensor Heater
Z28 Oxygen Sensor 2 Heater
Z29 Oxygen Sensor Heater
Z30 Oxygen Sensor 2 Heater



Additional Signals and Connections

1. Crash Signal (In) from Airbag Control Module
2. Air Conditioner Requirement Signal (In)
3. Air Conditioner Compressor Signal (In-Out)

CAN-BUS L, CAN-Bus H — Connection to Data Bus

X, Y, Z — Connection in Functional Diagram

Color Coding

- Input Signal
- Output Signal
- Positive
- Ground
- Bidirectional

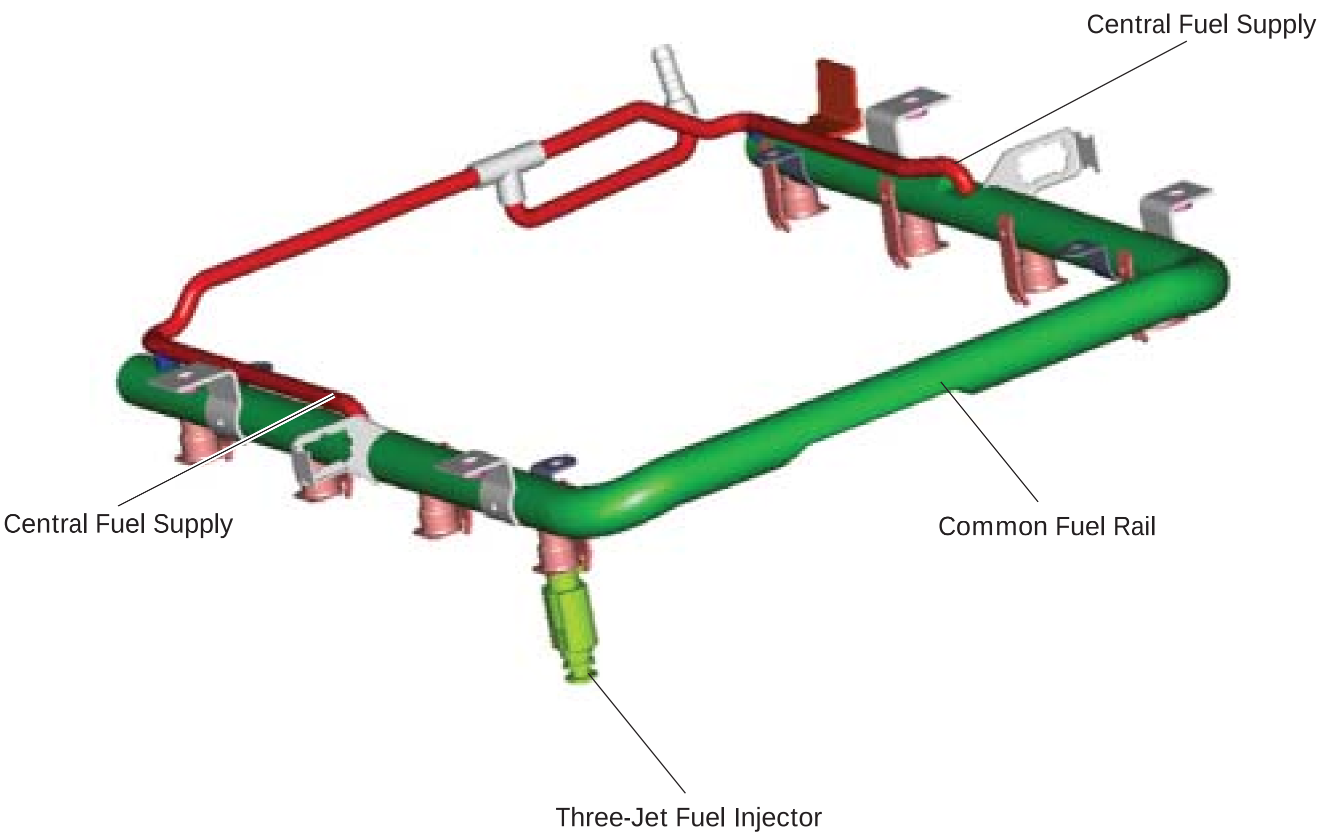
Fuel Injection System

The 4.2-liter V8-5V gasoline engine uses a common fuel rail and central fuel supply in a non-return system.

Fuel is supplied under pressure by two controlled fuel pumps located in the fuel tank.

Fuel is fed to both sides of the common fuel rail at the center of each cylinder bank for distribution directly to the center of each fuel injector.

Three-jet fuel injectors are located in the intake manifold near the intake valves at each cylinder.



SSP217/106

Quick-Start Functions

Camshaft Position Sensors

As with the V6-5V engines, the V8-5V engines also have two sensors for determining the position of the camshaft:

- Camshaft Position Sensor G40
- Camshaft Position Sensor 2 G163

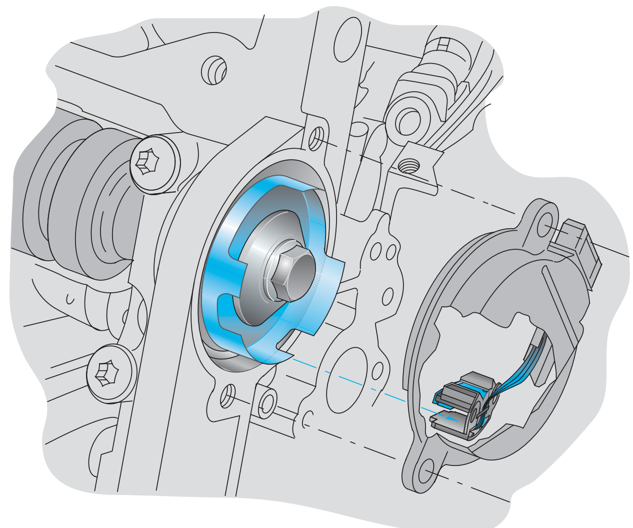
The sender system with “quick-start rotor ring“ used in the four-cylinder five-valve engines is implemented here as well.

The quick-start rotor ring is a shutter wheel with four alternating vanes and air gap openings — two wide and two narrow.

When an air gap is in the pickup range, the sensor is subjected to a greater magnetic field and the signal output is high. When a rotor vane is in the sensor pickup range, the signal output is low.

The alternating vanes and air gaps pass the Hall sensor in a sequence that produces a distinctive pulse width pattern for each 90° of camshaft rotation as the magnetic field is interrupted by the rotor vanes.

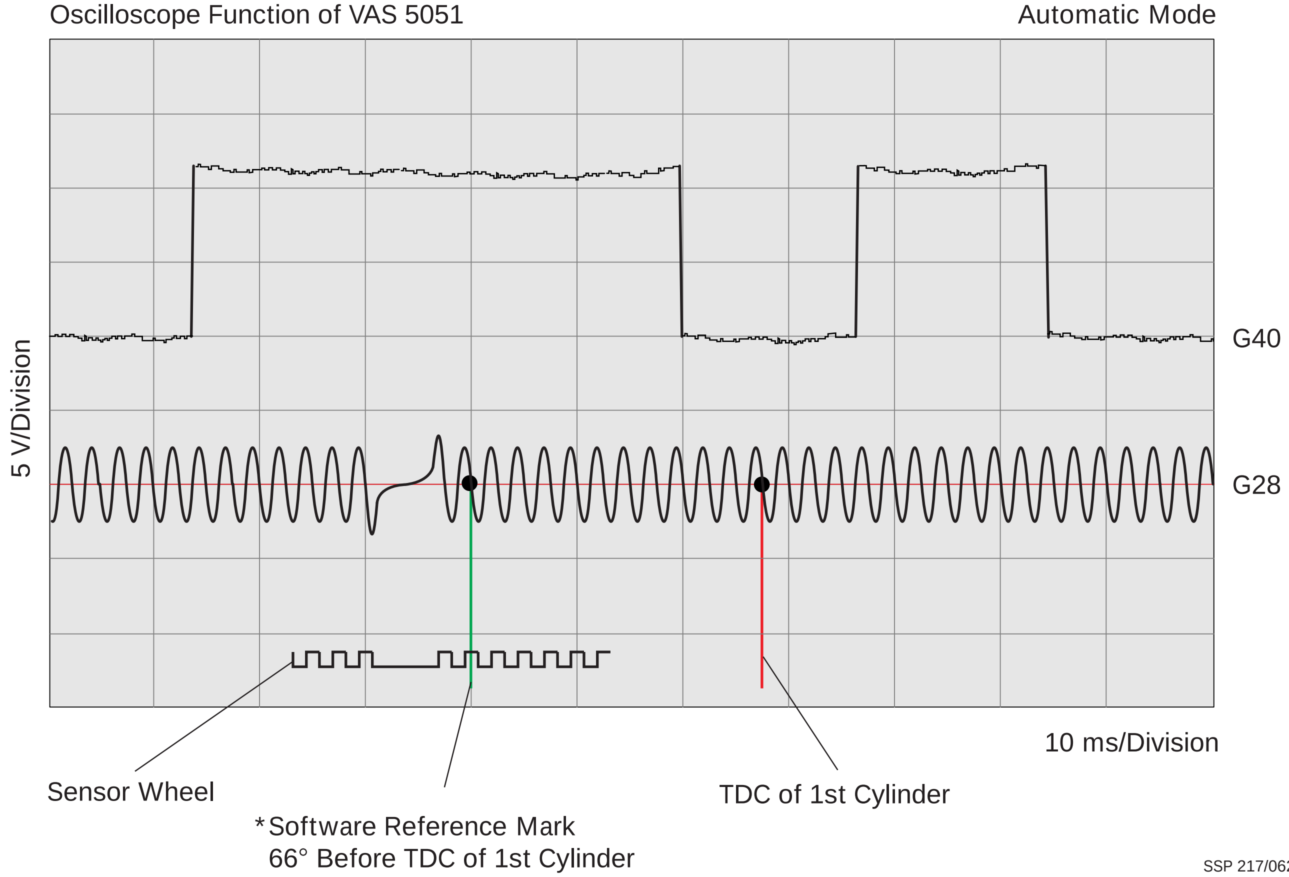
This distinctive signal pattern from Camshaft Position Sensor G40 is used together with input from Engine Speed Sensor G28 by the Motronic Engine Control Module J220 to determine the camshaft position relative to the crankshaft more quickly.



SSP 217/053

When the engine is started , the Motronic Engine Control Module J220 can thus determine the ignition TDC of the next cylinder more quickly so that the engine starts more quickly (synchronization with the first cylinder is no longer necessary). This is referred to as quick-start synchronization or the quick-start function.

Signal trace for Engine Speed Sensor G28 and Camshaft Position Sensor G40 Using Oscilloscope Function of VAS 5051



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*The software reference mark is the point from which the Motronic Engine Control Module J220 begins its calculations to determine the ignition point. It is about one tooth after the hardware reference mark, which is approximately 66° to 67° of crankshaft rotation before ignition TDC of the first cylinder.

The Camshaft Position Sensor 2 G163 is used to monitor camshaft adjustment and to generate a substitute signal if the Camshaft Position Sensor G40 fails.

The Camshaft Position Sensor G40 is mounted to cylinder bank 2.

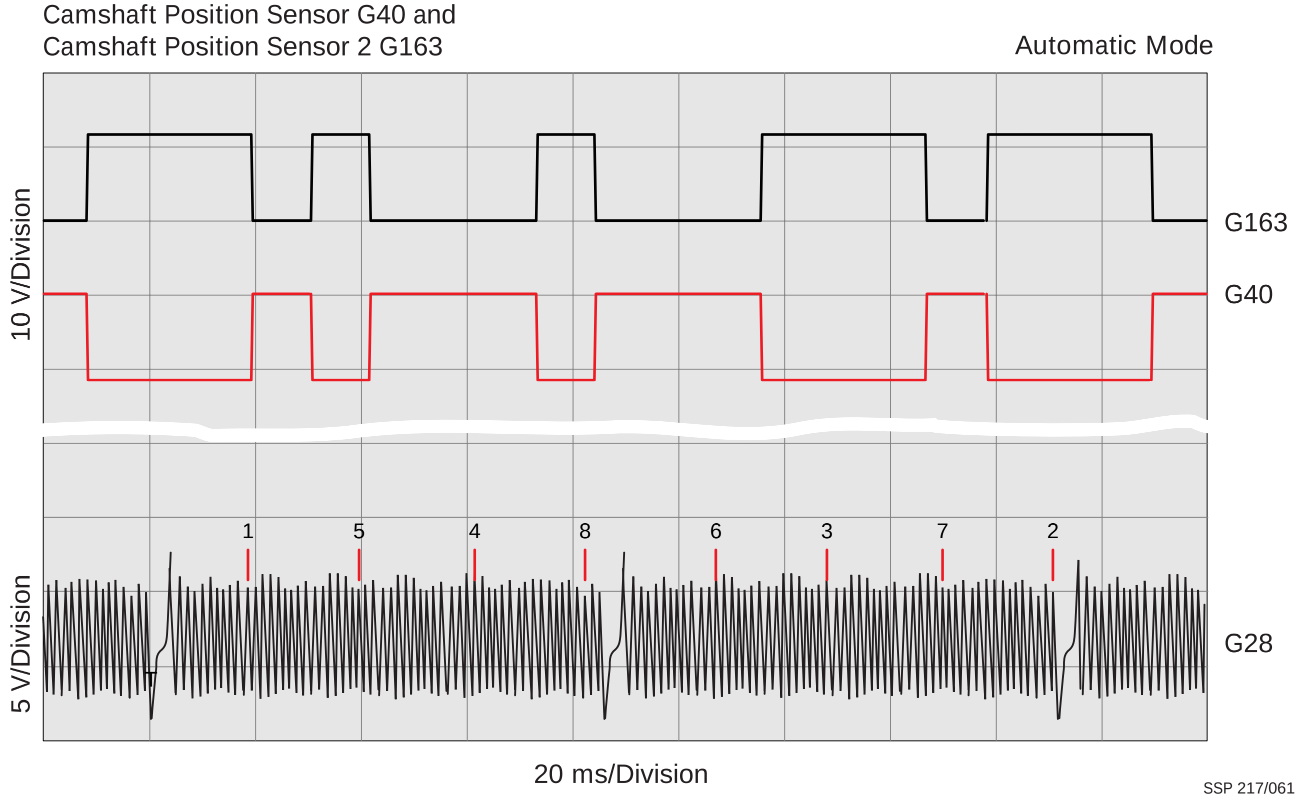
The Camshaft Position Sensor 2 G163 is mounted to cylinder bank 1.

Engine Run-Down

The Motronic Engine Control Module J220 remains active for a defined time after the ignition has been turned off and, with the aid of the Engine Speed Sensor G28, monitors the engine as it slows to a standstill.

The position of the engine mechanical components (position of the next cylinder at ignition TDC) is stored and is available the next time the engine is started.
The ME 7.1.1 can immediately begin injection and has a fuel mixture ready, which results in faster starting.

Signal trace of Engine Speed Sensor G28, Camshaft Position Sensor G40 and Camshaft Position Sensor 2 G163



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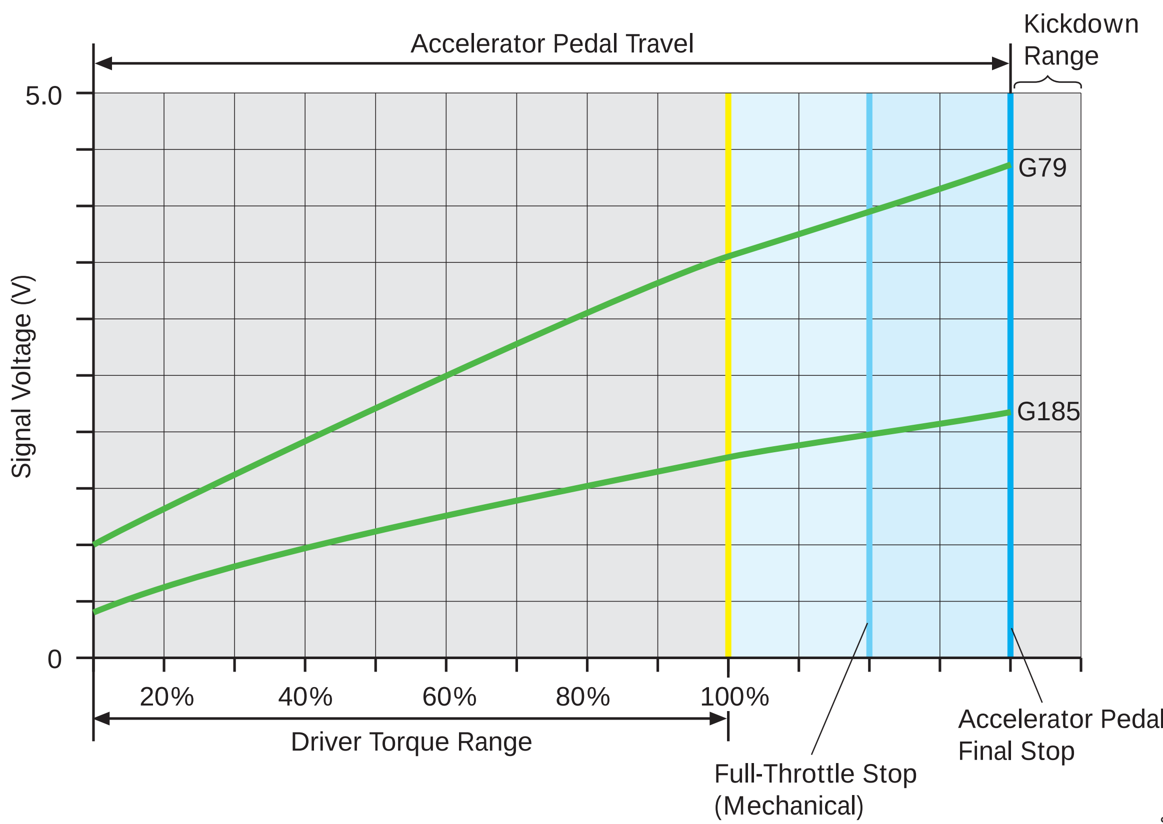
Electronic Throttle Function

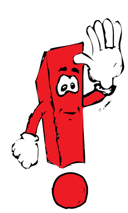
Accelerator Pedal Module

No separate switch is used to provide kickdown information. In the case of automatic-transmission vehicles, the accelerator pedal stop is replaced by a pressure element. The pressure element generates a mechanical pressure point which gives the driver the “kickdown feeling.“

If the driver activates the kickdown, the full-throttle voltage of the accelerator pedal position senders is exceeded. If a voltage defined in the engine control module is reached, this is interpreted as a kickdown and the information is sent to the automatic transmission via the CAN data bus. The kickdown switching point can only be tested using Vehicle Diagnosis, Test and Information System VAS 5051.



SSP 217/060



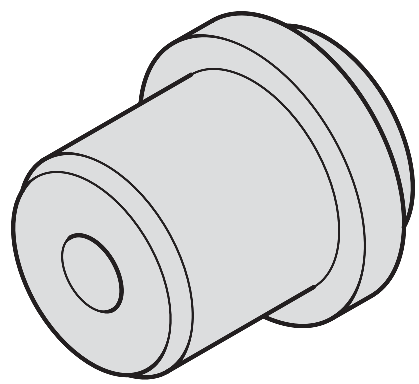
If the accelerator pedal module or the Motronic Engine Control Module J220 is changed, you will need to perform the adaptation function using the VAS 5051.

Special Tools

A number of new special tools are required for repairing the V8-5V engine.

Thrust Pad for Crankshaft Oil Seal

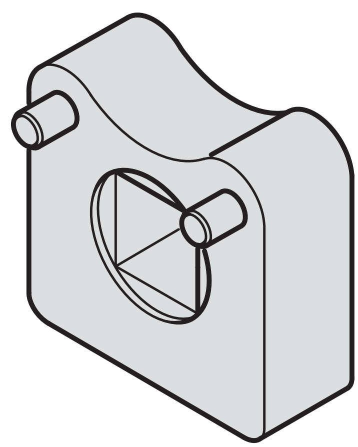
Order No. T40007



SSP 213/007

Tensioning Roller Spanner

Order No. T40009



SSP 213/008

Camshaft Retainer

Order No. T40005

SSP 213/009

Notes

Notes

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

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

You can find this Knowledge Assessment at:

www.vwwebsource.com

From the vwwebsource.com Homepage, do the following:

- Click on the Certification tab
- Type the course number in the Search box
- Click “Go!” and wait until the screen refreshes
- Click “Start” to begin the Assessment

For Assistance, please call:

Certification Program Headquarters

1 – 877 – CU4 – CERT
(1 – 877 – 284 – 2378)

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

Or, E-Mail:

Comments@VWCertification.com

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