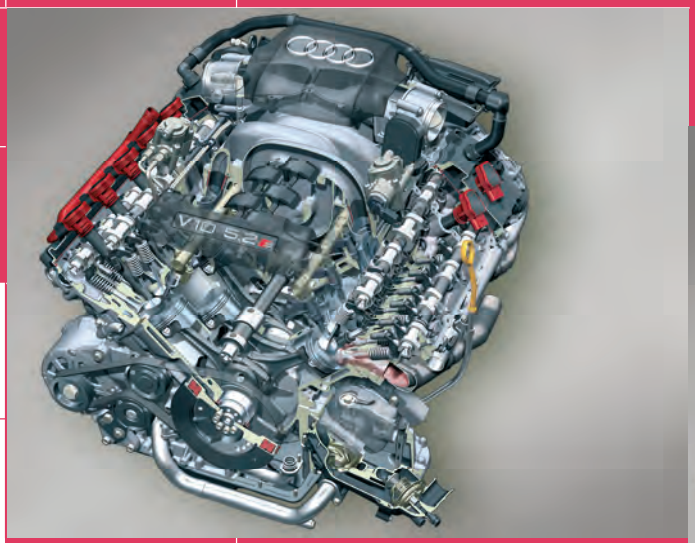
Service Training





The 5.2L V10 FSI Engine
Design and Function

Self-Study Program 923603

Audi of America, Inc.
Service Training
Printed in U.S.A.
Printed 1/2007
Course Number 923603

©2007 Audi of America, Inc.

All rights reserved. All information contained in this manual is based on the latest information available at the time of printing and is subject to the copyright and other intellectual property rights of Audi of America, Inc., its affiliated companies and its licensors. All rights are reserved to make changes at any time without notice. No part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, nor may these materials be modified or reposted to other sites without the prior expressed written permission of the publisher.

All requests for permission to copy and redistribute information should be referred to Audi of America, Inc.

Always check Technical Bulletins and the latest electronic repair information for information that may supersede any information included in this booklet.

Trademarks: All brand names and product names used in this manual are trade names, service marks, trademarks, or registered trademarks; and are the property of their respective owners.

Table of Contents

Engine Specifications 1

Engine Concept 3

Air Intake System (S8) 18

Fuel System (S8) 20

Exhaust System 26

Bosch MED 9.1 System (S8) 28

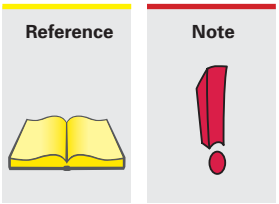
CAN-Bus Interface 30

Knowledge Assessment 33

The Self-Study Program provides introductory information regarding the design and function of new models, automotive components or technologies.

The Self-Study Program is not a Repair Manual!
All values given are intended as a guideline only and refer to the software version valid at the time of publication of the SSP.

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



Notes

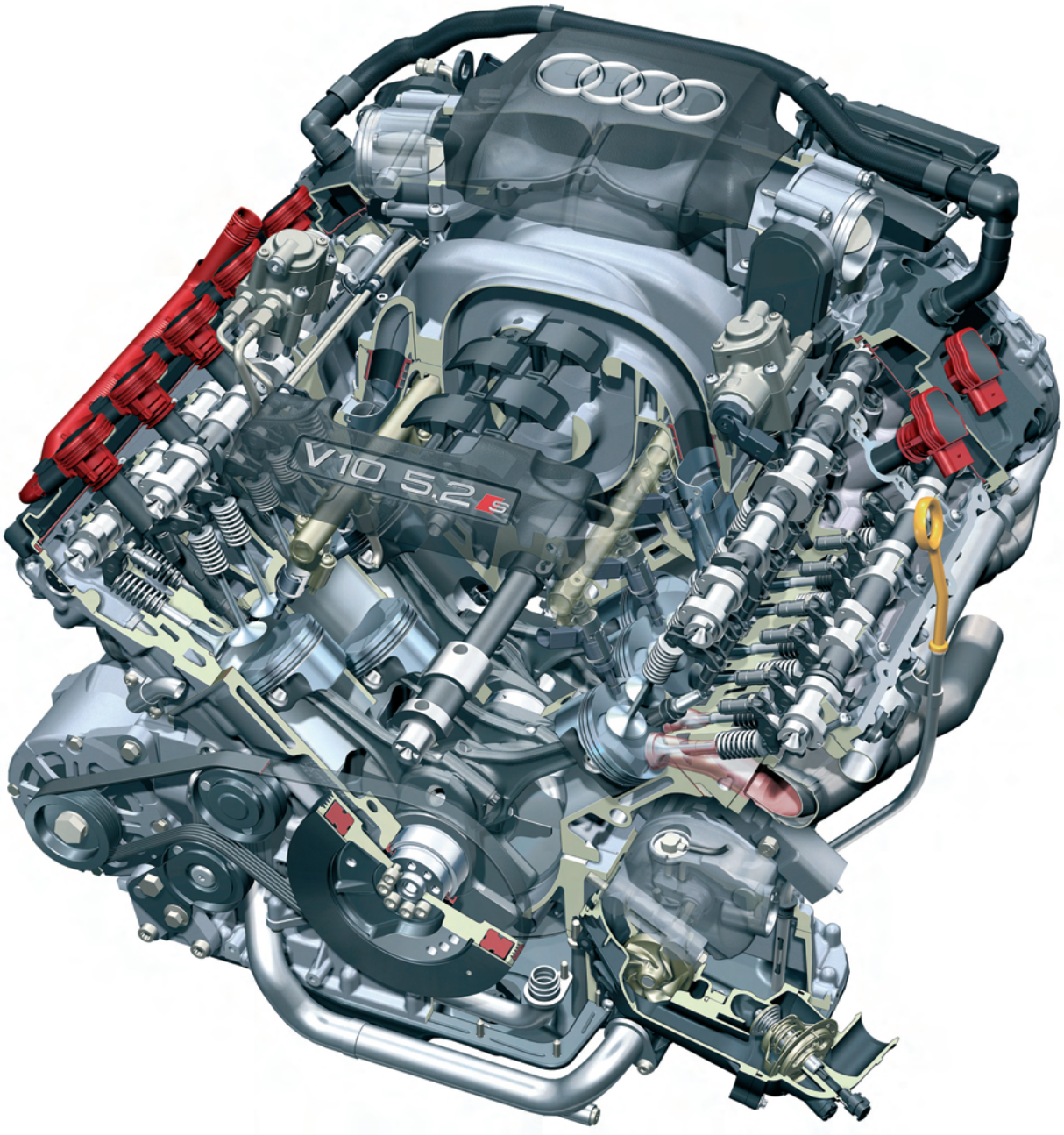
Introduction

For the first time in its history, Audi is offering a 10-cylinder engine for production based vehicles. This 5.2 liter engine will be used in both the Audi S6 and S8 models.

A 10-cylinder engine is synonymous with dynamic power as seen in the Gallardo engine built by the Italian super sports car brand Lamborghini, a subsidiary of Audi. The combination of 10 cylinders and FSI technology gives Audi a unique position in the market.

The 5.2L engine belongs to the next generation of Audi V engines. It features a 90° V angle with 90 mm between cylinder centers. Similar in design to the Lamborghini V10 engine, the Audi version differs in that the bore, stroke, and displacement have all been increased.

A 5-liter V8 engine would have been more compact, but the pistons and connecting rods would also need to be heavier, thereby limiting the engine. It would not rev as freely as a V10 and would diminish the sporty characteristics.

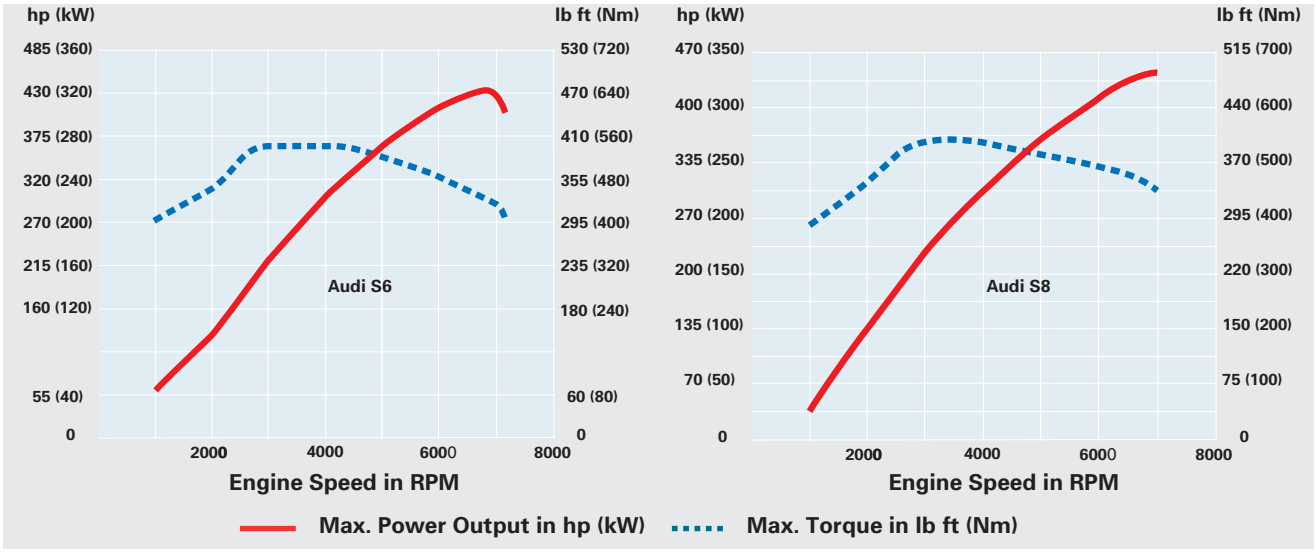


Engine Specifications

The engine code is stamped into a boss above the crankshaft pulley near the oil pressure switch.



Torque and Horsepower



Technical Data

	S6	S8
Engine Code	BXA	BSM
Type of Engine	V10 Engine with 90° V-angle	
Displacement	318 cu in (5204 cc)	
Power Output	429 hp (320 kW)	444 hp (331 kW)
Torque	398 lb ft (540 Nm) at 3000-4000 RPM	
Cylinder Spacing	3.5 in (90 mm)	
Bore	3.3 in (84.5 mm)	
Stroke	3.7 in (92.8 mm)	
Compression Ratio	12.5 : 1	
Firing Order	1–6–5–10–2–7–3–8–4–9	
Engine Weight	Approximately 485 lb (220 kg)	
Engine Management	Bosch MED 9.1 – Master-Slave Principle	
Exhaust Gas Recirculation	Internal	
Exhaust Emission Control	4 main catalytic converters, 4 pre-cat and 4 post-cat oxygen sensors	
Exhaust Emission Standard	EU IV/LEV II	

Cylinder Block and Crankcase

The 5.2L V10 engine is based on the design of the 4.2L V8 engine with the addition of two cylinders. The V10 cylinder block, cylinder heads, camshaft drive, fuel system, and intake manifold concept were adapted from the V8 engine.

Unique to the V10 are the crankshaft, balance shaft, dual path intake manifold with two throttle housings, exhaust manifold, and engine management system with two control modules.

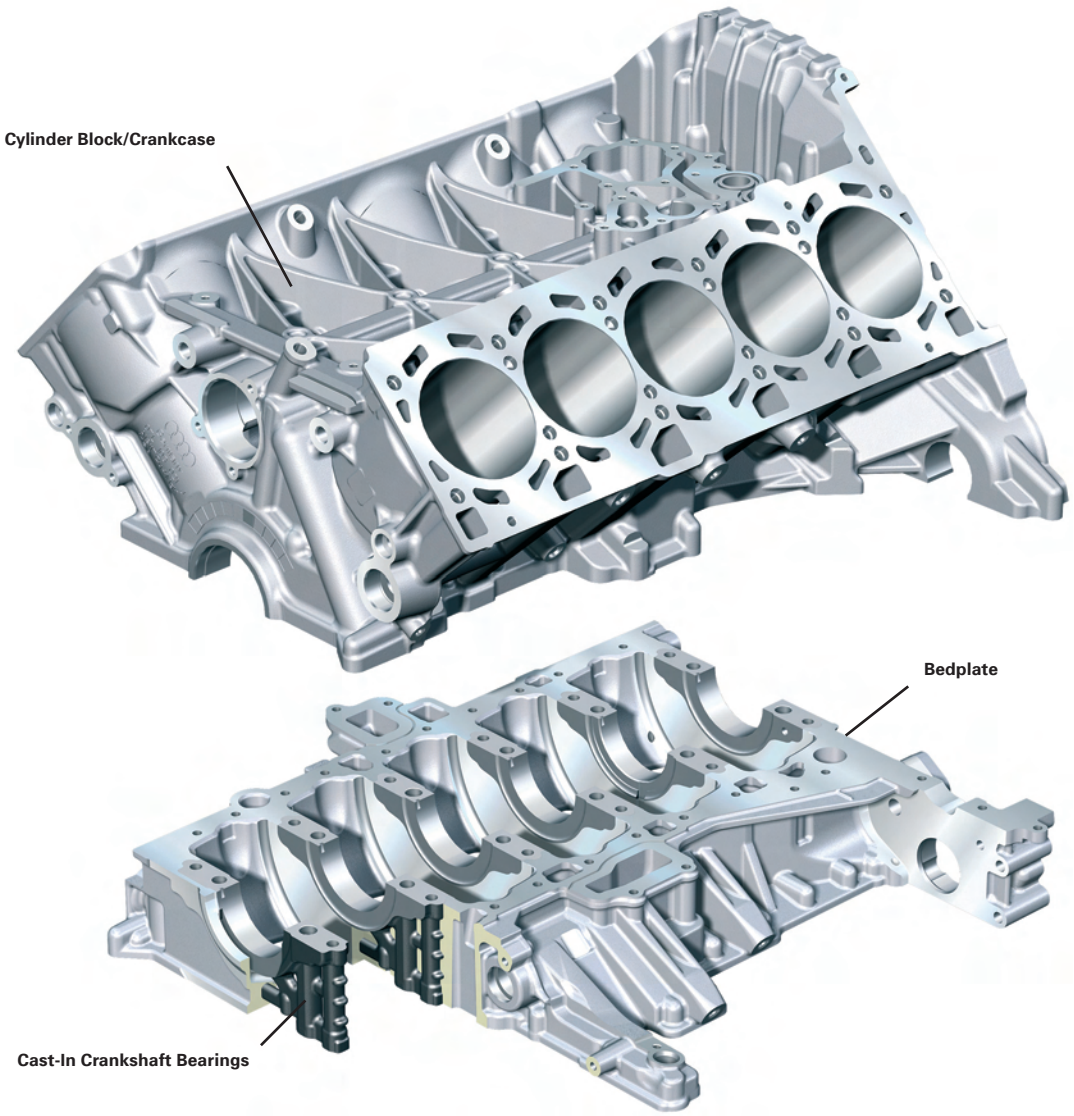
The cylinder block/crankcase is a two-piece construction with a 90° angle for the cylinders. With a length of 37 inches (685 mm) and width of 31.5 in (801 mm) the V10 is a compact engine with a bare block weight of approximately 104 lb (47 kg).

The upper cylinder block/crankcase is manufactured as a homogeneous low pressure casting from AlSi17Cu4Mg (hypereutectic aluminum alloy). This design and material provides high strength, good heat dissipation, and allows closer cylinder spacing.

When the aluminum alloy solidifies during the casting process, it produces pure silicon crystals and aluminum silicon mixed crystals. A special cylinder honing process exposes the separated silicon crystals and in the process creates wear resistant cylinder contact surfaces that eliminate the need for cylinder liners.

The gray cast iron lower main bearings are cast into the bedplate during manufacturing. This reduces thermal expansion and crankshaft endplay.

The bedplate is cast from AlSi12Cu1. It is a ladder type frame that is bolted to the bottom of the cylinder block/ crankcase. This provides high torsional rigidity and reduces the vibrational characteristics of the engine.



Crankshaft

As in all V configuration engines, two connecting rods are attached to each crankshaft throw. With a cylinder bank angle of 90°, the individual crankshaft pins are offset 18° relative to their corresponding opposite cylinders. This is a “split pin” configuration and results in a desired ignition interval of 72°.

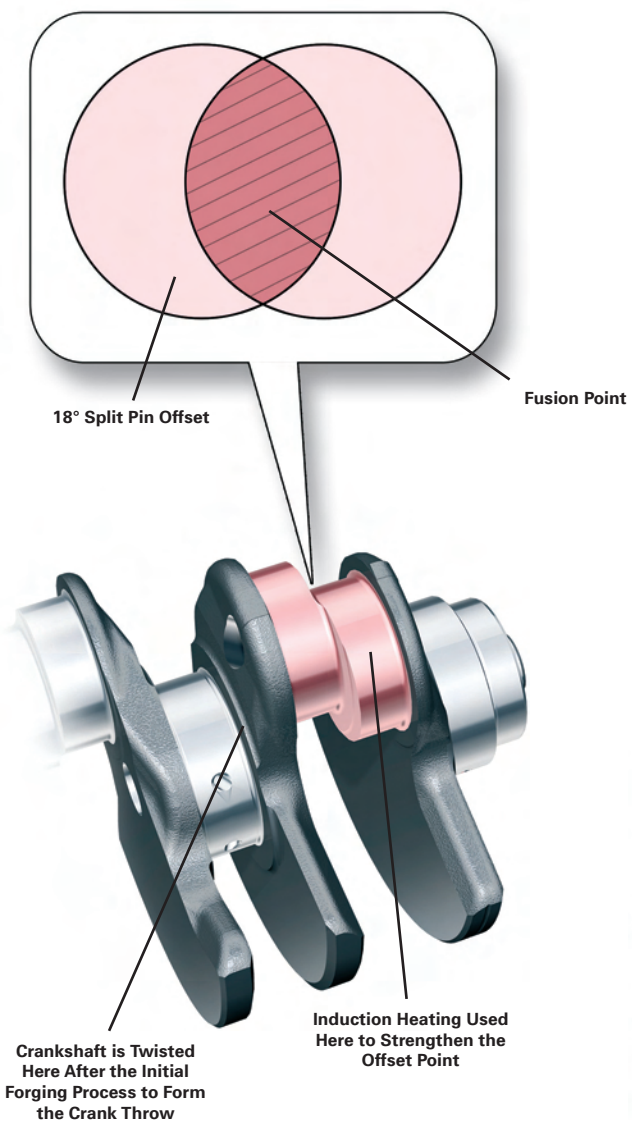
The split pin design of the crankshaft throws require special manufacturing processes. This is because the fusion point of the individual crankshaft pins is the place a crankshaft could most easily break.

The strengthening of the crankshaft is accomplished in two ways during its manufacture. The crankshaft is first forged from a hot steel billet in a stamping process.

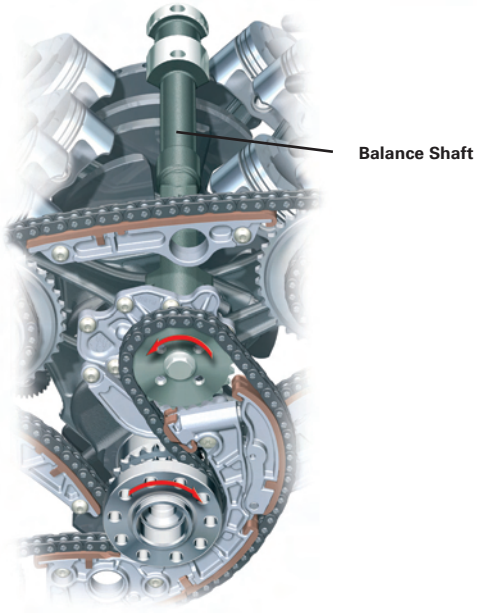
While it is still hot, the crankshaft is twisted to form the crankshaft throws. This produces a very dense, tough shaft with a grain running in the direction of the principle stress.

Secondly, the shoulder of the connecting rod throws are hardened by an inductive heating method. This method heats the outer surfaces but does not heat the core.

Free mass vibrations are compensated for by a nodular cast iron balance shaft that turns opposite to engine rotation at crankshaft speed. It is located in the V section of the upper crankcase housing between the cylinder banks.





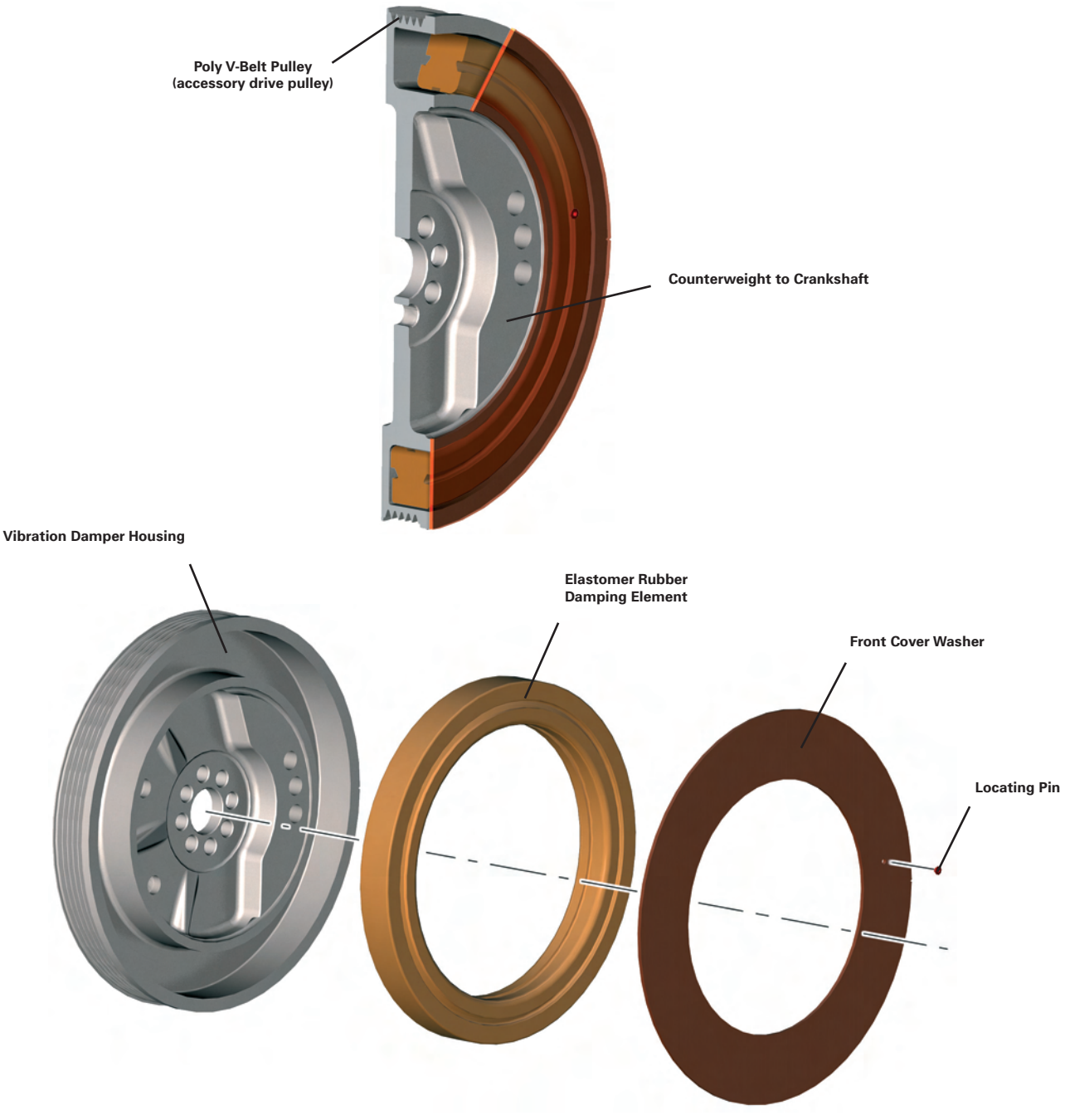


Vibration Damper

To absorb crankshaft torsional vibration created by piston power stroke, a vibration damper is used at the front of the engine.

The damper consists of three main components: a counterweight to the crankshaft, the accessory drive pulley, and a bonded element (elastomer rubber) that joins the two pieces together.

In addition to the elastomer rubber damping element, a special viscous oil is used. This oil dampens the relative movement between the elastomer rubber element and the accessory drive pulley. This action not only reduces torsional stress placed on the crankshaft by the combustion process but also reduces stress to the crankshaft from accessory components driven by the poly-V belt.



Connecting Rods

The connecting rods are a familiar trapezoidal design forged from 36MnVS4 high-strength steel. This design reduces oscillating masses and distributes the combustion force more evenly.

The lower end of the connecting rods are cracked after forging. During the cracking process, the connecting rod is split at a predetermined breaking point using a special tool. The resultant unique breaking surface ensures the high joining precision of the two mating parts.

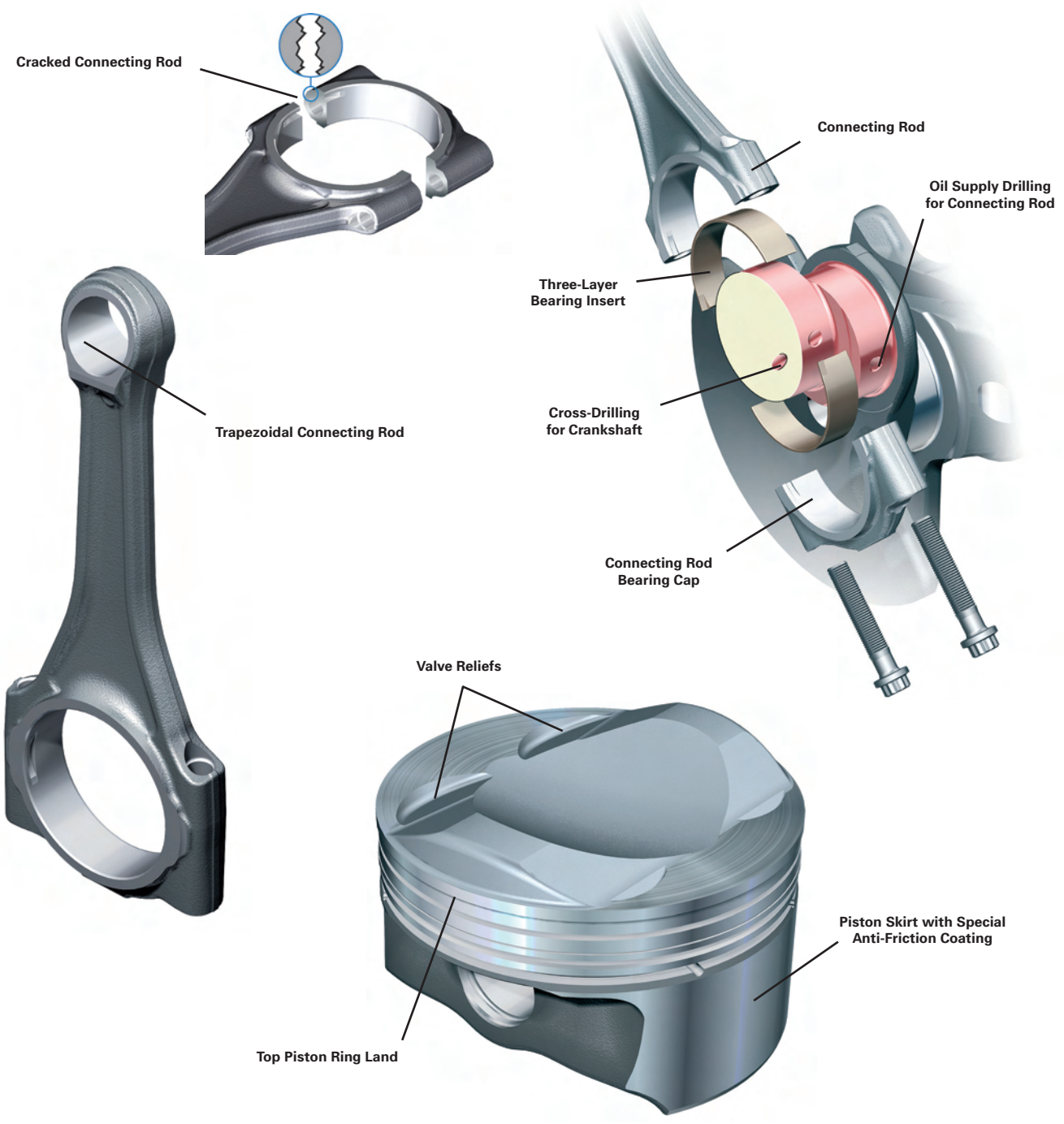
The connecting rods are cross-drilled to allow engine oil to lubricate the rod bearings and piston pins.

Pistons

The cast aluminum pistons are manufactured by the firm Kolben Schmidt. They have a special piston head design that supports the FSI combustion principle. The design aids in the tumble effect of the fuel mixture during its intake stroke.

The piston skirts are electro-coated with a special iron-based friction reducing material to minimize wear under load.

Spray jets located on the engine block provide cooling to the underside of the piston and the piston pins.



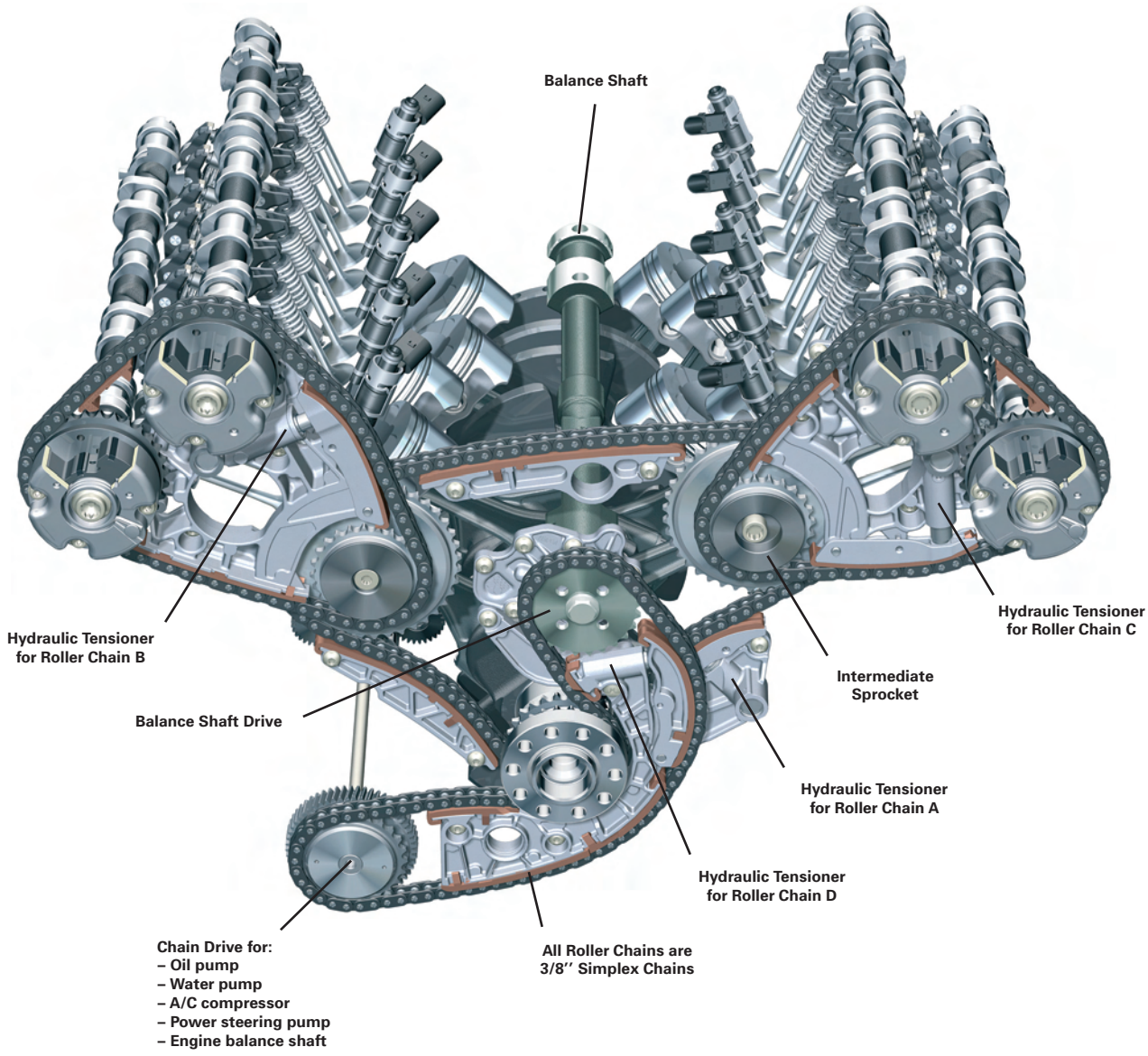
Chain Drive Operation

A chain drive system mounted on the flywheel side of the engine provides the necessary power to operate the four camshafts, oil pump, A/C compressor, and the hydraulic power steering pump.

Four 3/8'' roller chains operating at two levels are used. Roller chain A distributes power from the crankshaft to two intermediate sprockets. Roller chains B and C distribute power from these sprockets through additional sprockets to the camshafts. Roller chain D is driven by the crankshaft and provides drive power for the engine oil pump, water pump, A/C compressor, power steering pump, and the engine balance shaft.

The balance shaft is mounted in the V of the engine block. It turns at engine RPM in the opposite direction of engine rotation. Special attention must be paid when installing the balance shaft. Excessive vibration will occur if it is installed in the wrong position.

All chains are tensioned by hydraulic tensioners.



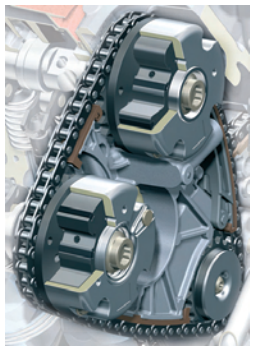
Cylinder Head

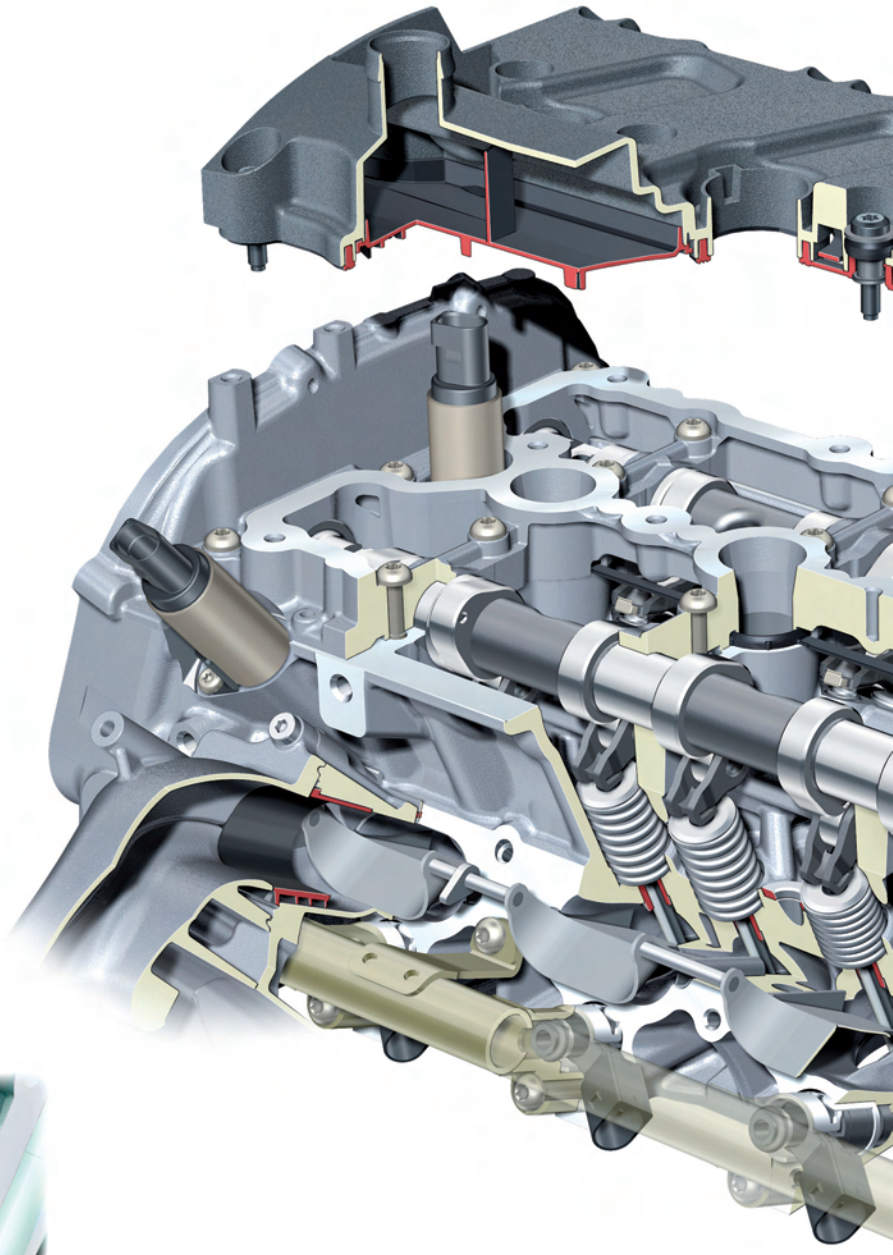
The cylinder head design of the new V10 FSI engine is based on the same concept as the 2.0L 4V FSI engine.

The camshafts are held in place by one-piece die-cast aluminum ladder bearing frames to reduce the number of components and to increase rigidity and acoustic characteristics.

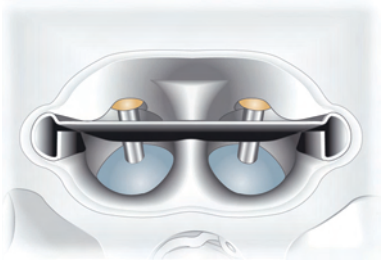
The ladder bearing frames are machined at the ends and in the bearing slots after their assembly with the cylinder heads. This results in flat axial sealing surfaces between the cylinder head covers, the ladder bearing frames, and their attached modular housings.

Intake and exhaust camshaft adjustment is accomplished hydraulically. The adjusters are mechanically locked into place until sufficient oil pressure is developed. The adjustment range of the camshafts is 42°.

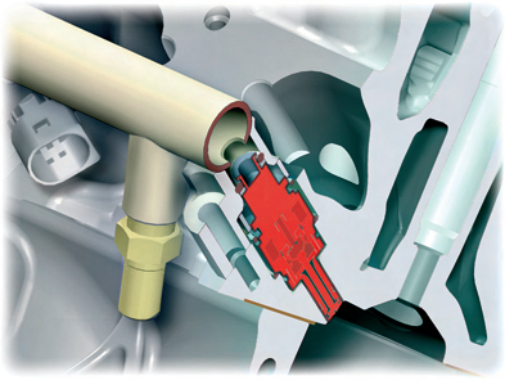




A partition plate separates the intake path into the upper and lower halves.

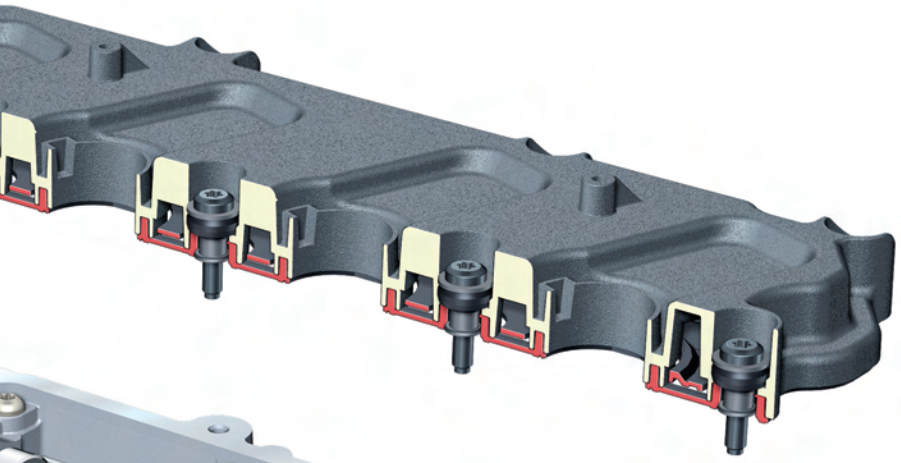


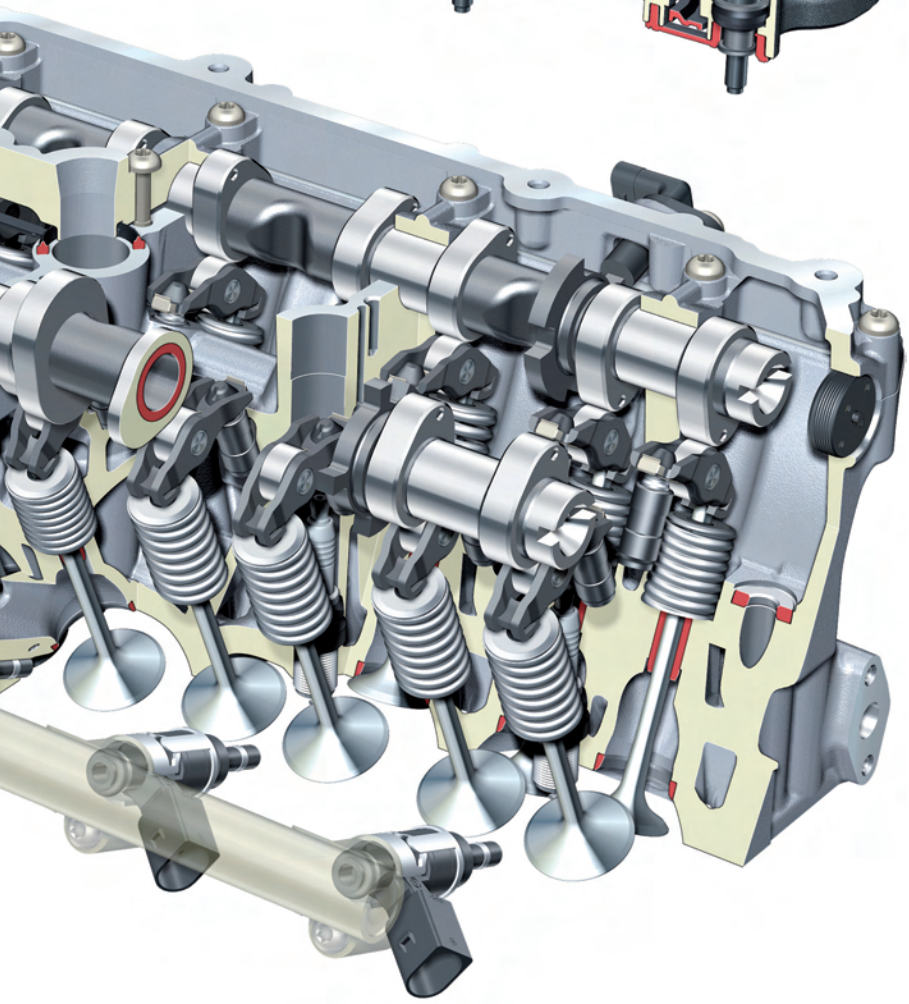
The fuel injector sits directly in the combustion chamber of the cylinder at an angle of 7.5°.

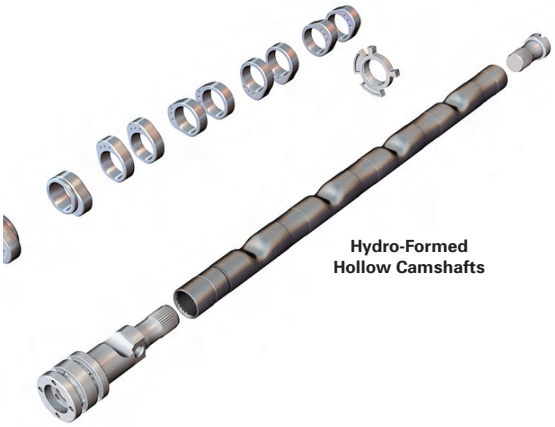


In order to reduce rotating mass, the camshafts are hollow. The cam lobes are then attached using a high pressure water injection process. Valve clearance is compensated by the use of hydraulic lifters. The oil supply is directed through cross-drilled passages in the cylinder head. The intake valves and sodium filled exhaust valves are operated directly by roller rocker arms.

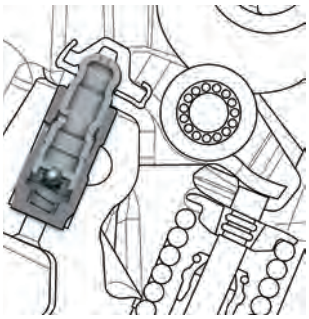
Secondary air passages are cast into the cylinder head. Air injection downstream of the outlet valves causes oxygen enrichment of the exhaust gases. As a result, the hydrocarbons and carbon monoxide undergo post-oxidation (afterburning). The thermal energy released during this process heats up the catalytic converters so they reach operating temperature more quickly.



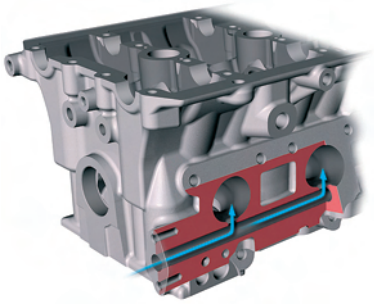




Hydro-Formed Hollow Camshafts



Hydraulic Lifters



Secondary Air Passages

Crankcase Ventilation

Blow-by gases created during the combustion process must be ventilated from the crankcase. Excess blow-by can cause sludge and acids, leading to coking of the intake valves.

Crankcase ventilation is accomplished in the V10 engine using a cyclone oil separation process and fresh air from the air cleaner housing. In this process, the oil mixed with blow-by gas is separated and returned to the engine.

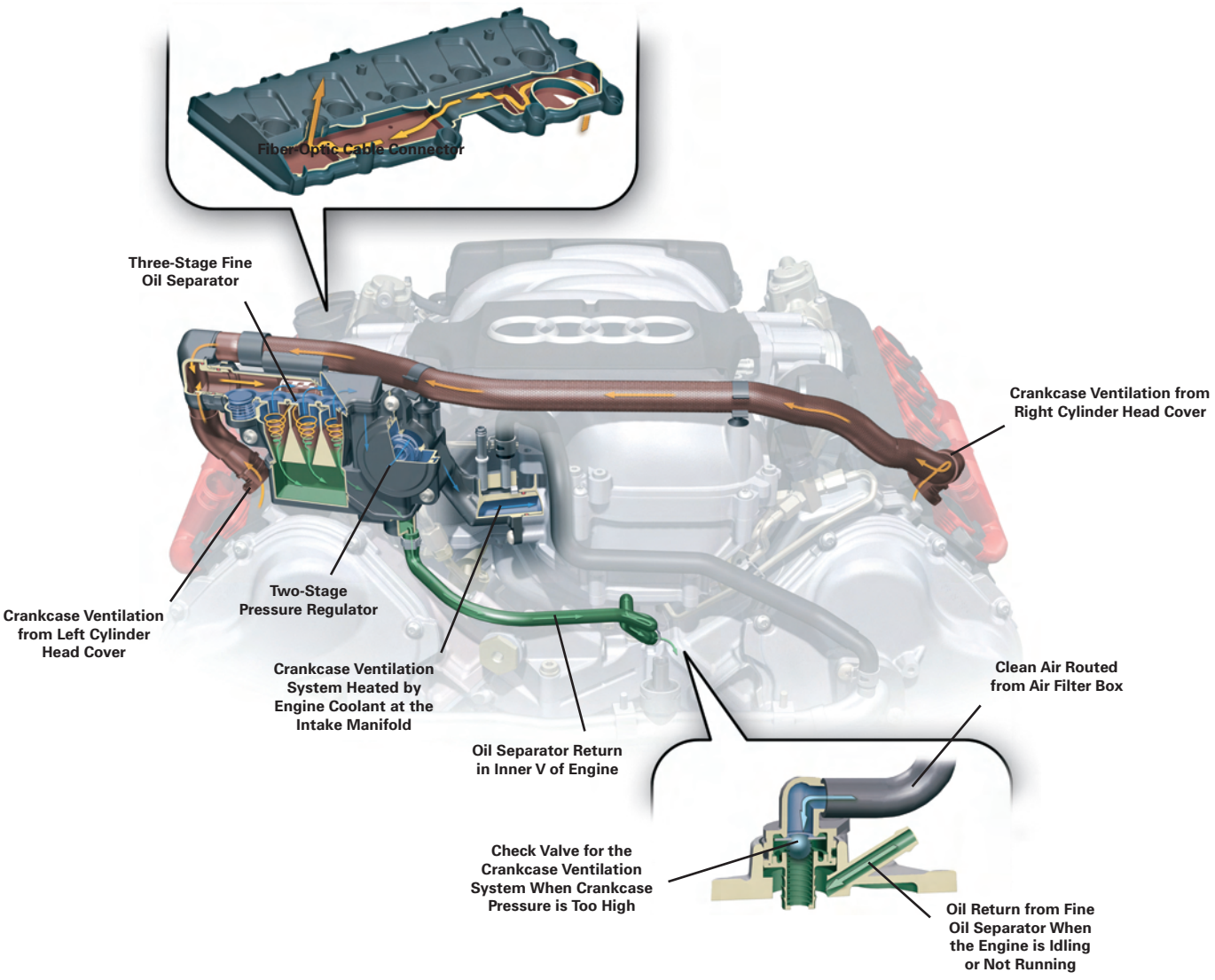
Each cylinder head cover has channels cast in its housing. These channels direct blow-by gases from the crankcase to a cyclone fine oil separator. The channels also allow some of the oil mixed with blow-by gases to return to the crankcase by gravity. Blow-by gases are directed from the cylinder head covers to the fine oil separator by plastic hose.

The fine oil separator has three cyclone oil separators: a control piston, bypass valve, two-stage pressure limiting valve, and an oil return valve. Its purpose is to remove the fine oil particles mixed with the blow-by gases and return them to the crankcase.

After the blow-by gases have passed through the fine oil separator, they flow into the intake manifold downstream of the throttle bodies. The inlet point of the blow-by gases is also integrated with the engine cooling system. This prevents the system from freezing.

The crankcase ventilation system also includes a crankcase breather. Air is drawn from the air filter box and flows through a check valve into the crankcase at the inner V. The mixture of fresh air helps ensure a reduction of water and fuel mixture in the crankcase from the blow-by gases.

A damping chamber is located below the check valve in the engine block. This helps prevent check valve flutter and eliminates noise.

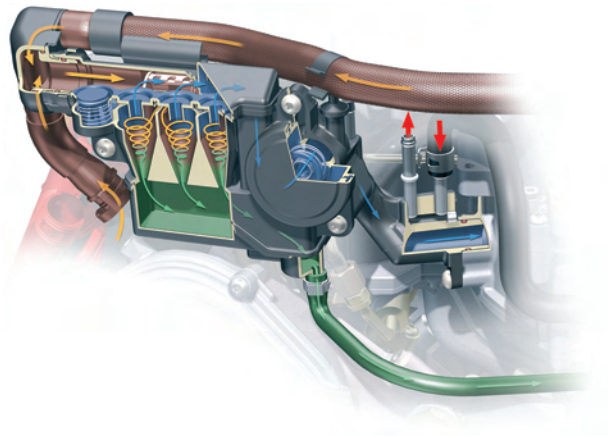


Fine Oil Separator

Blow-by gas volume is dependent on engine load and RPM.

The cyclone oil separators have a high separation efficiency over only a limited volumetric range. For that reason, one, two, or all three cyclones operating in parallel will be needed depending on blow-by volume.

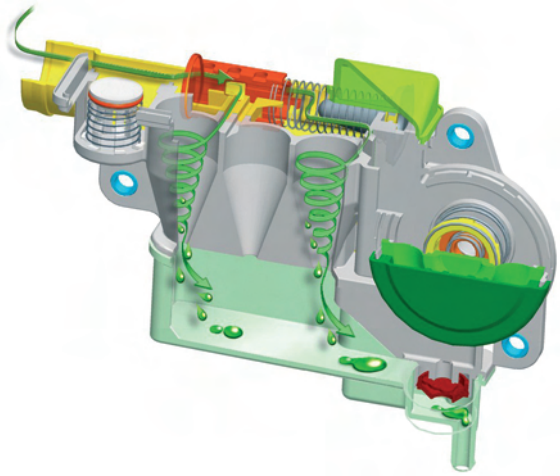
Internal crankcase pressure is regulated by the two-stage pressure control valve. The by-pass valve, together with the control piston, ensure that the cyclones work at the optimum operating point. If the volumetric flow rate is too high or too low, it will impair cyclone operation.

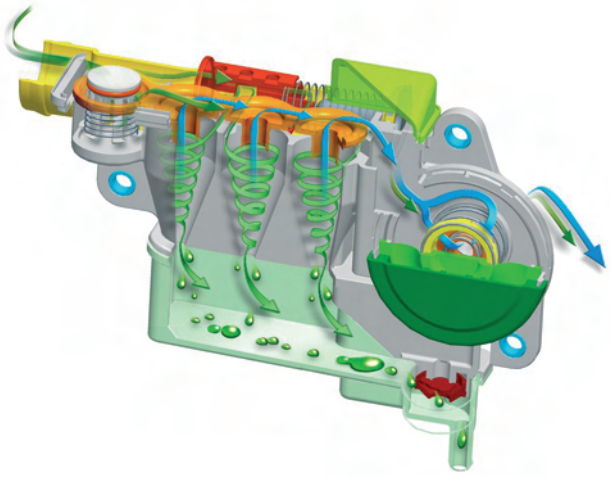


When engine load and RPM are high, blow-by gas flow volume is high. Blow-by gas pressure against the control piston works against the spring pressure and opens passages to more cyclones.

Separated oil is collected in an oil reservoir beneath the cyclones. It cannot drain out of the reservoir until the oil drain valve is opened. The oil drain valve is closed as long as the pressure in the crankcase is higher than in the oil separator. The valve opens automatically due to gravity only at very low engine RPM or when the engine is not running becuse the pressures are at equilibrium. (See top right illustration, below.)

When the engine is running at very low load but at a very high RPM, the piston rings can begin to flutter. The blow-by gas pressure is very high and the fine oil separator is unable to operate at its peak efficiency. At this point, the by-pass valve opens and a fraction of the blow-by gas flows to the intake manifold untreated. (See bottom illustration.)

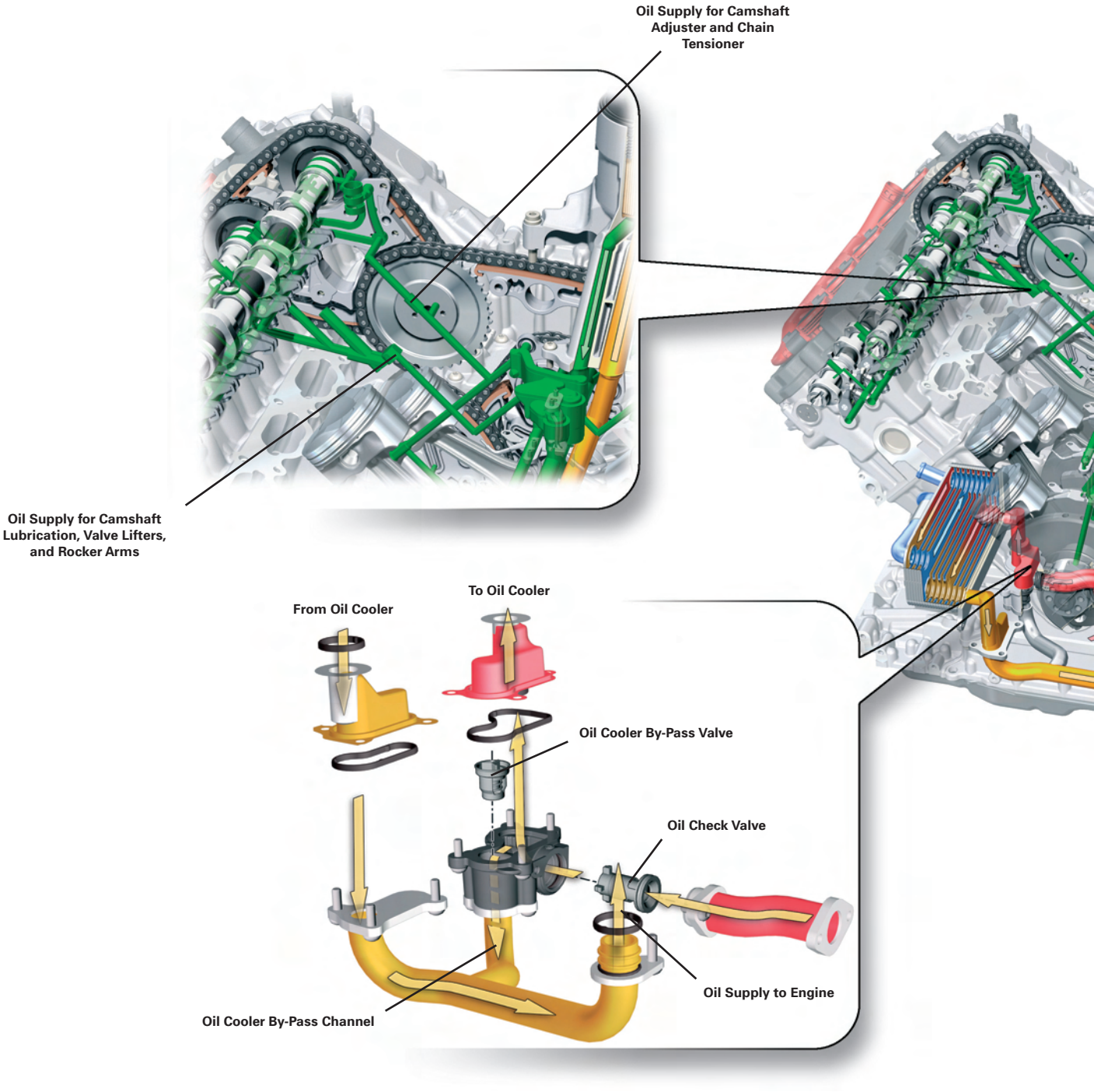




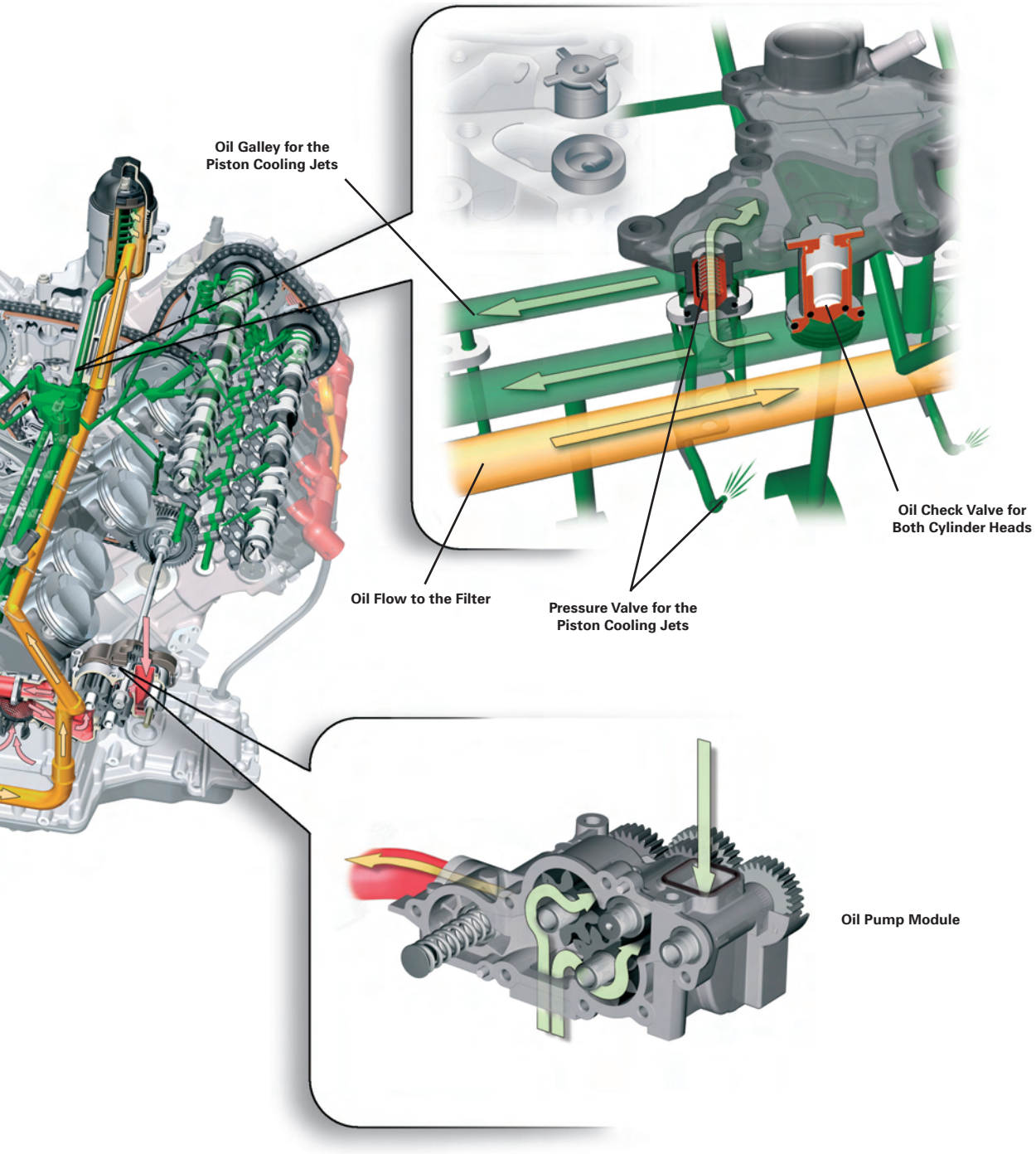
Oil Circulation

The oil supply in the 5.2L V10 engine is based on a traditional wet sump concept. The focal point of development was on significant reduction of the oil flow rate through tighter bearing tolerances. With a lower flow rate, the oil remains in the sump longer and is able to recover from aeration better.

At an oil temperature of 248°F (120°C), the flow rate of 58 qts (55 liters) per minute at 7000 RPM is very low for a 10-cylinder engine. This has helped to minimize oil pump drive power requirements and improve fuel economy.



The oil supply to the camshaft adjusters, camshaft, roller rockers, valve lifters, and chain tensioners has a check valve to retain oil in the cylinder head for optimizing the camshaft adjustment function.

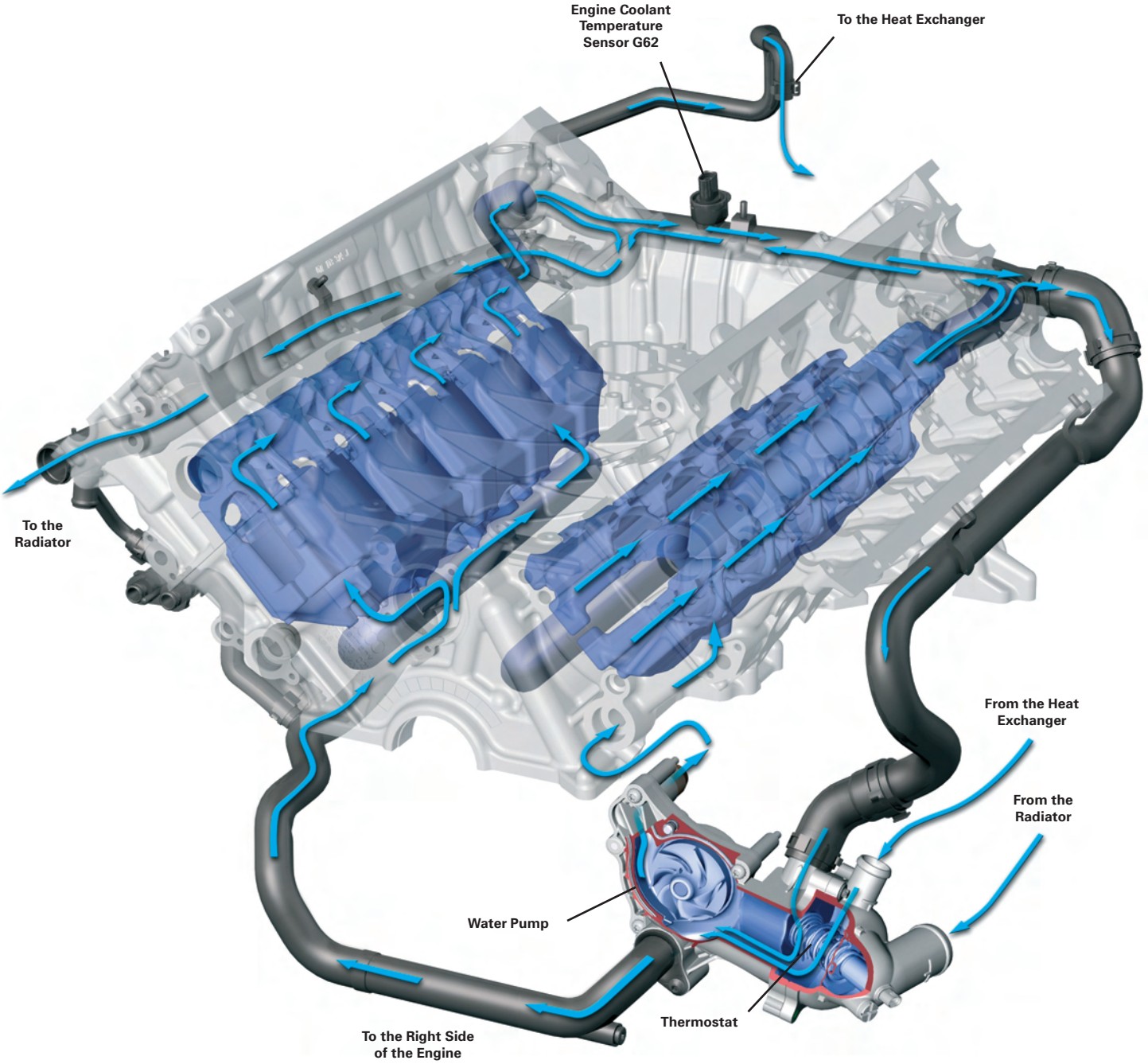


Engine Cooling System

The cooling system in the new V10 engine was configured as a longitudinal-flow cooling system. The cooling water flows first through the engine block, flushing around the cylinders. From there it flows up into the cylinder head and flows longitudinally toward the back of the engine through the chain housing cover.

The cooling system can be divided into large and small circuits dependent on coolant temperature and position of the thermostat. Coolant will be circulated either to the radiator (when the engine is fully warmed) or through the small circuit (when the engine is cold or warming up).

Due to the high power developed by this engine, and thermal stress on the intake valves, additional water bores are used to provide more cooling.



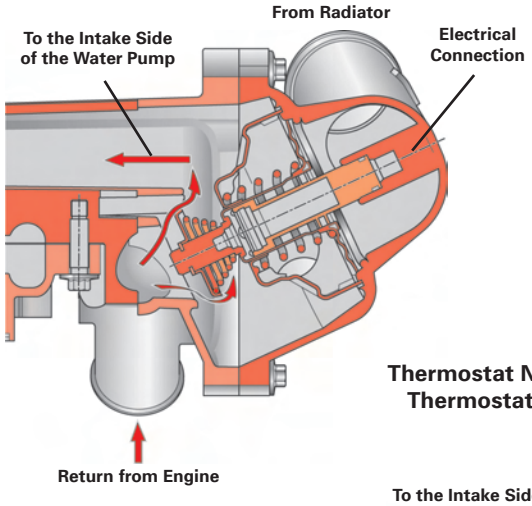
The V10 uses an electronically controlled cooling system to regulate the coolant temperature between 194°F (90°C) and 221°F (105°C). This is accomplished through the use of a Pulse Width Modulated signal to the thermostat actuator.

The thermostat blocks the opening to the radiator and opens the return channel for the short cooling circuit. The inlet to the radiator is partially opened and the return to the small cooling circuit is partially closed. The engine coolant is regulated from a temperature of 221°F (105°C).

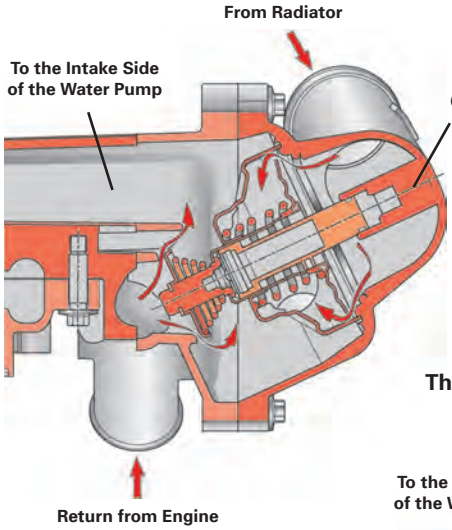
Friction values in the engine and accessory components lower as oil temperature increases. The thermostat completely opens the passage to the radiator while blocking the passage to the small cooling circuit.

The capacity of the radiator allows engine coolant temperature to drop the range of 194°F (90°C). This is optimal for cylinder charge filling and cooling, reducing the possibility of engine knock.

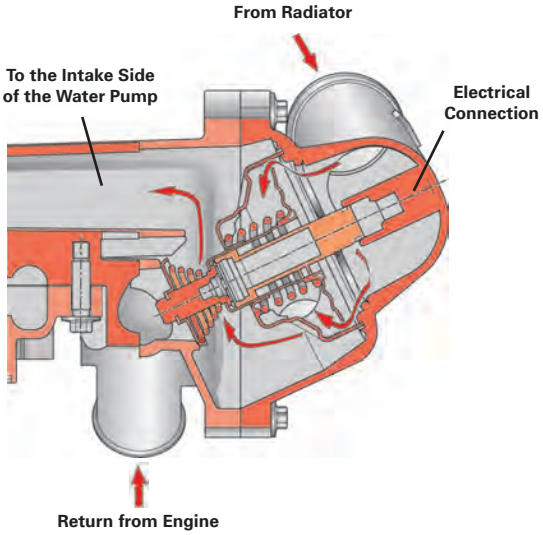
Thermostat Not Energized, Engine Coolant Cold



Thermostat Not Energized, Engine Coolant Hot — Thermostat Stays in an Intermediate Position



Thermostat Fully Energized by PMW Signal

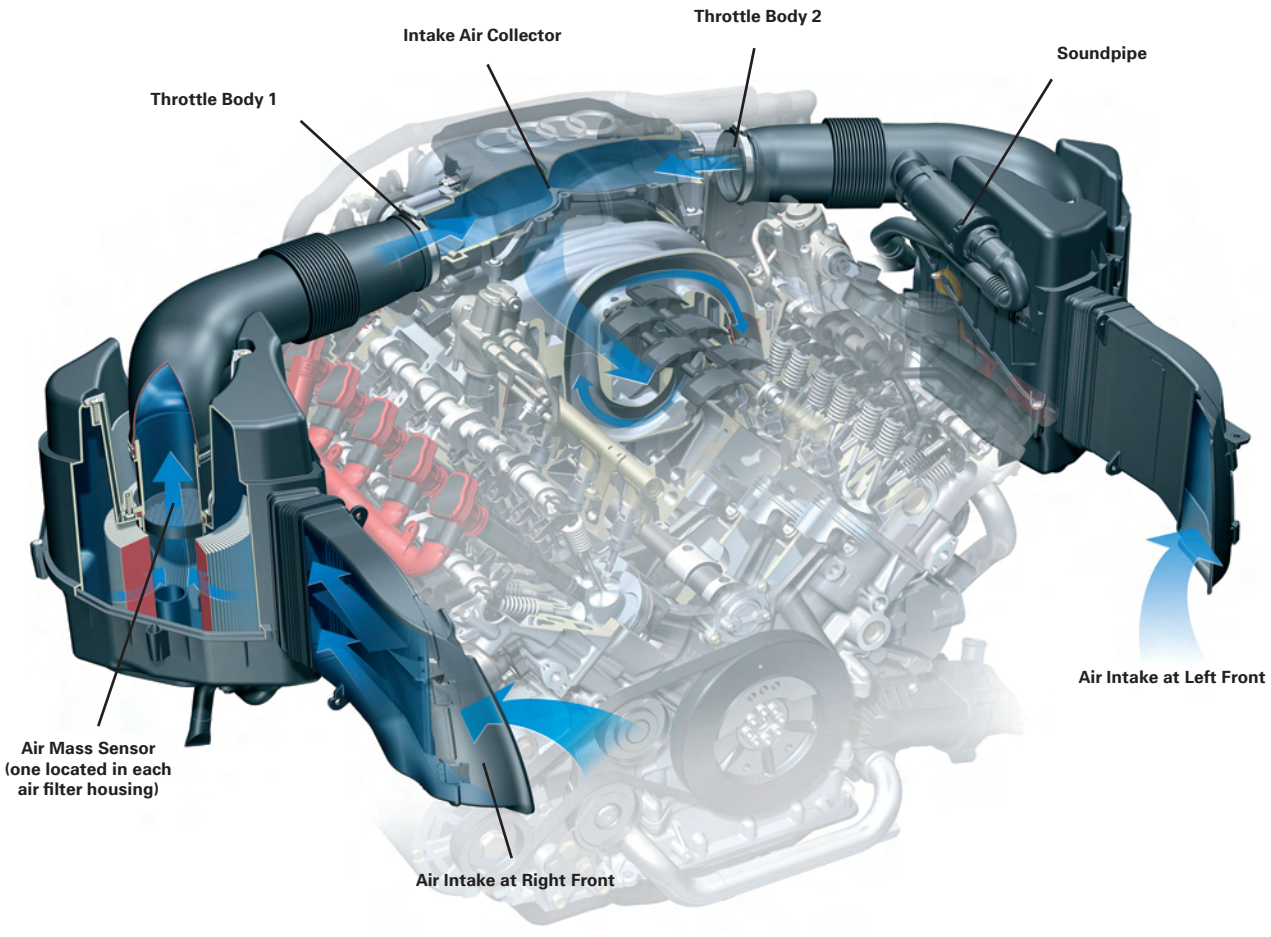


Air Intake System (S8)

The 5.2L V10 FSI engine (as used in the S8) has a dual intake air system. Two air filter housings are used, one mounted on each bank of cylinders. Each air filter housing has an additional power flap to allow more air into the intake system under high load and RPM operation. The power flaps are opened and closed by a vacuum actuator controlled by the engine control module.

An air mass sensor is mounted in each air filter housing. Two 2.68 in (68 mm) throttle valve bodies are also used.

To emphasize the sporting characteristics of the V10 engine, a Soundpipe (similar to the one in the 2007 Audi TT 3.2L V6 MPI engine) is used. It directs the intake air sound over a special diaphragm and tuning filter.



Intake Manifold Flaps

The intake manifold flaps are controlled according to a characteristic map in the Engine Control Module. They are activated in lower engine load and RPM ranges.

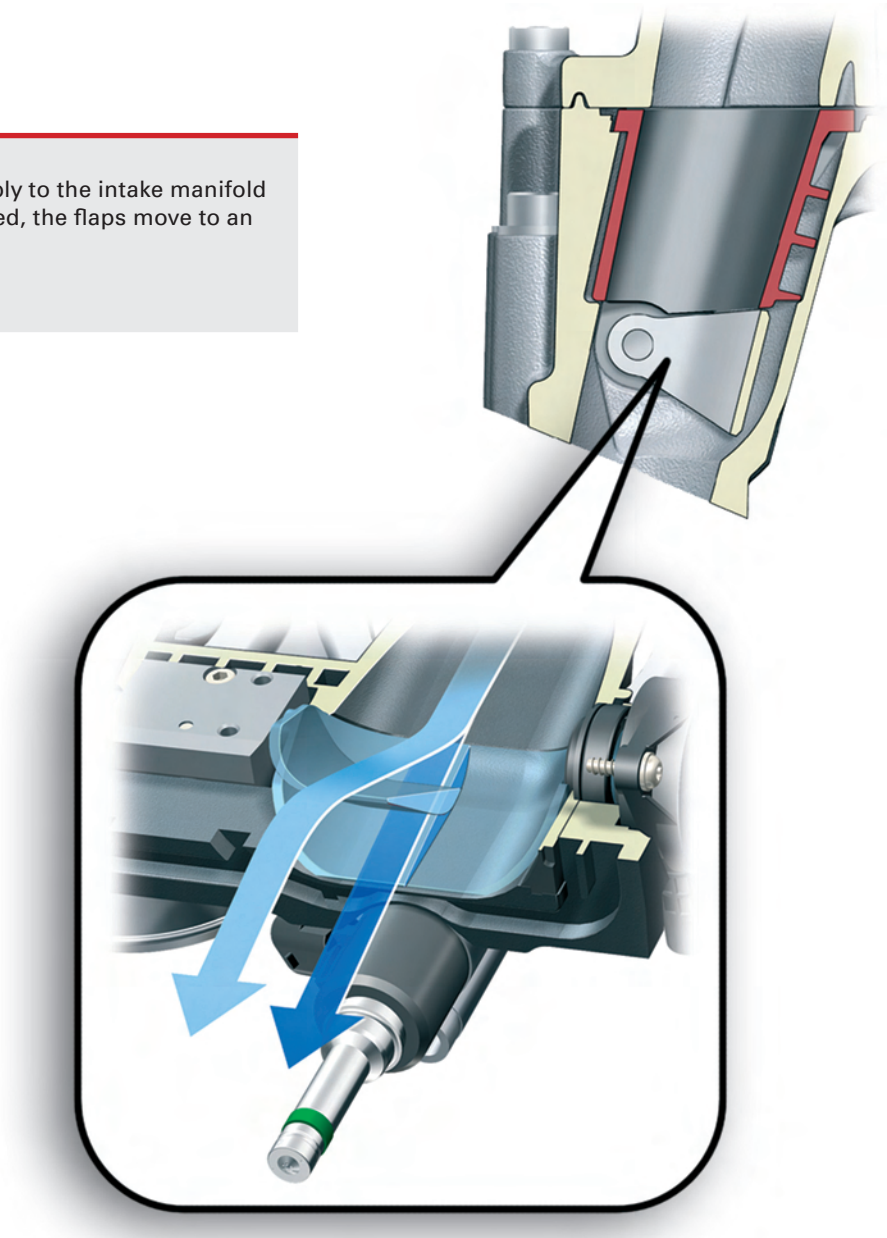
The flaps are brought into contact with the port baffles in the cylinder head and seal the lower part of the intake port. The intake air mass now flows through the upper section of the intake port and induces a tumbling charging motion inside the cylinder.

When not activated, the intake manifold flaps are open and the cross-sectional area of the port is maximized.

All flaps in a cylinder bank are attached to a common shaft. The flaps are activated through an electrical actuator. For each cylinder bank, the position of the intake manifold flaps is monitored by a Hall sensor.

Note

If the power supply to the intake manifold flaps is interrupted, the flaps move to an opened position.



Dual Path Intake Manifold

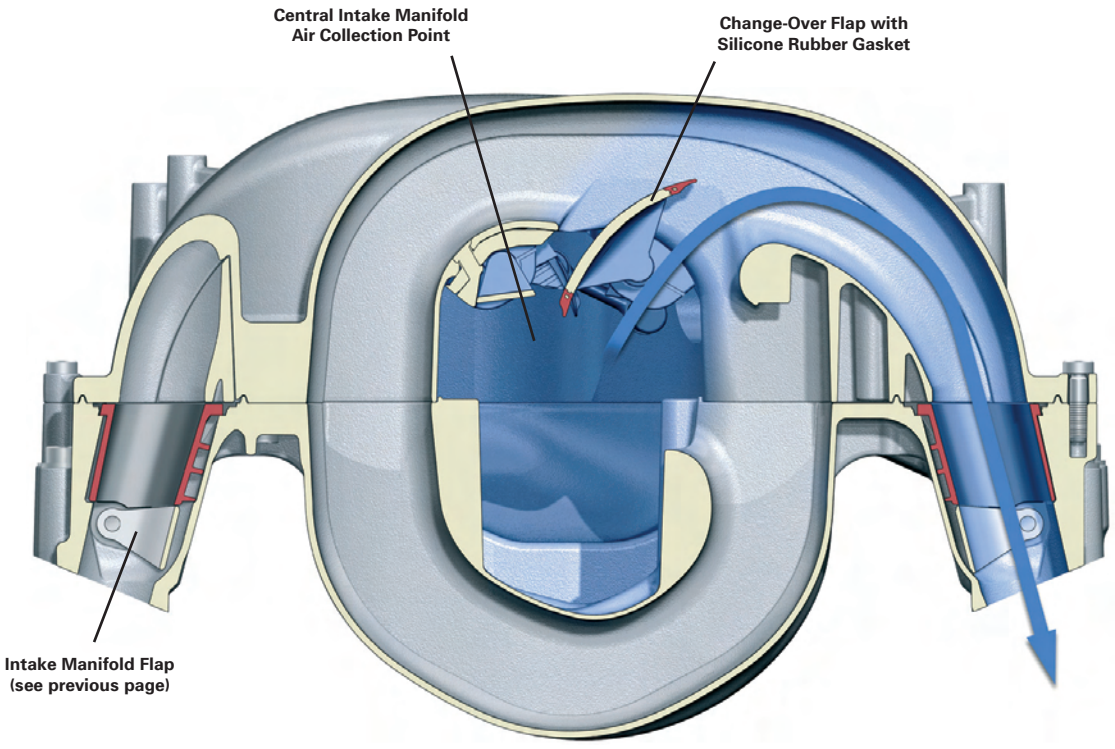
The 5.2L V10 FSI engine uses a dual path intake manifold made of cast magnesium. Change-over flaps in the intake manifold direct the air flow through either a long or short intake intake path depending on load and RPM operating conditions of the engine. The change-over is map-controlled by the engine control module (ECM). The change over flaps are actuated by the Variable Intake Manifold Runner Motor V183. No feedback of position is given to the ECM.

The flaps are precision fit in the upper part of the intake manifold. A silicone rubber seal is used on each flap to reduce the possibility of leakage due to air turbulence.

When the engine is operating under low load and RPM conditions, the intake manifold is switched to the short intake runners.

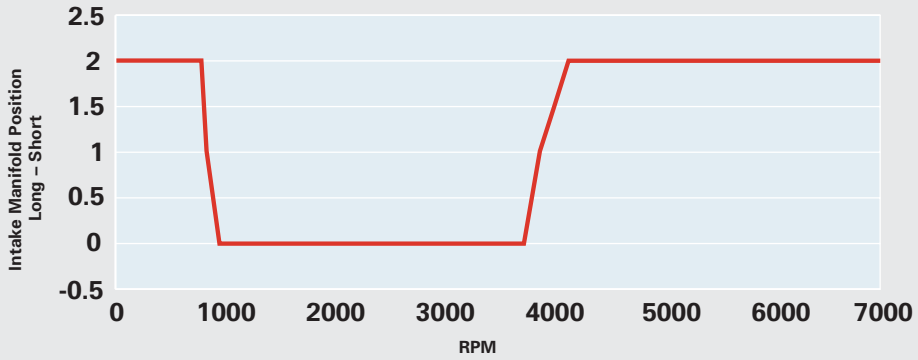
In the lower RPM range, a long intake manifold path is opened in order to increase torque. In the upper RPM range, a short intake manifold path is opened. This position produces an increase in engine power output.

Short Intake Path, Change-Over Flaps Open

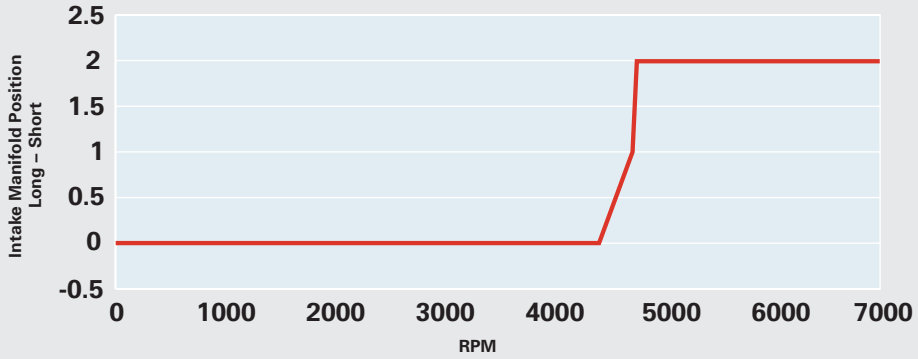


The Intake Manifold Length When in the Power Position (short path) is 12.1 in (307 mm)

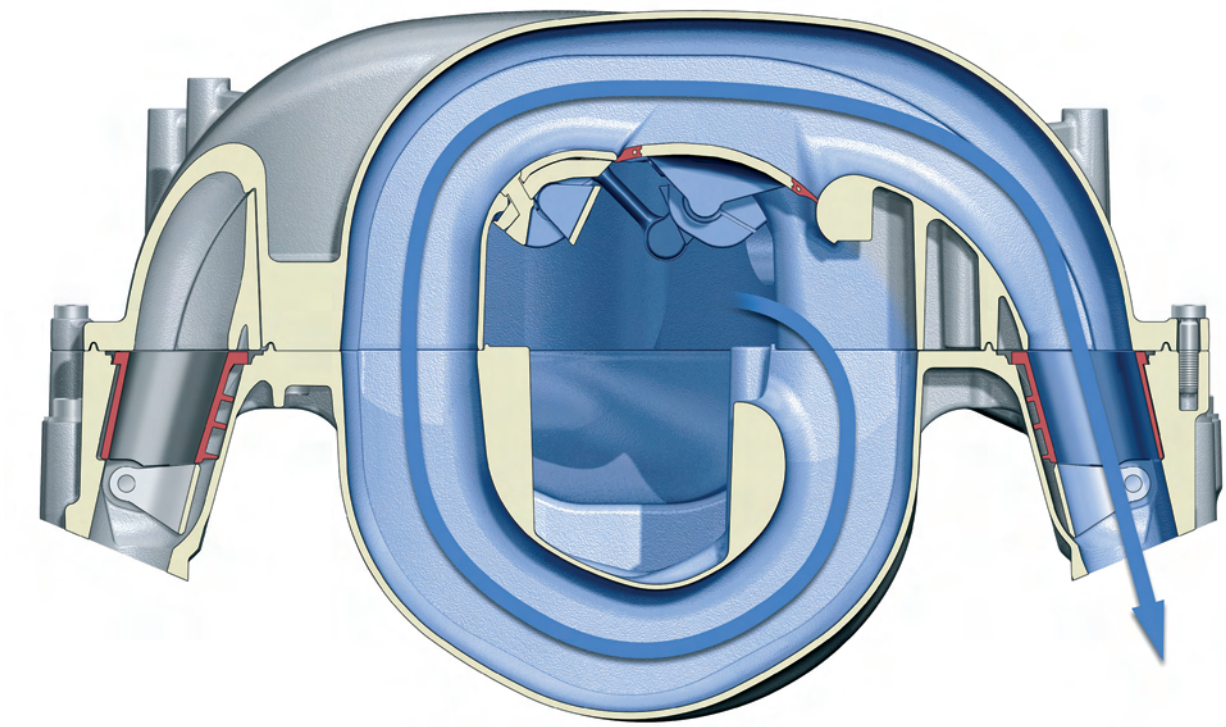
Intake Manifold Change-Over at Low Load



Intake Manifold Change-Over at High Load



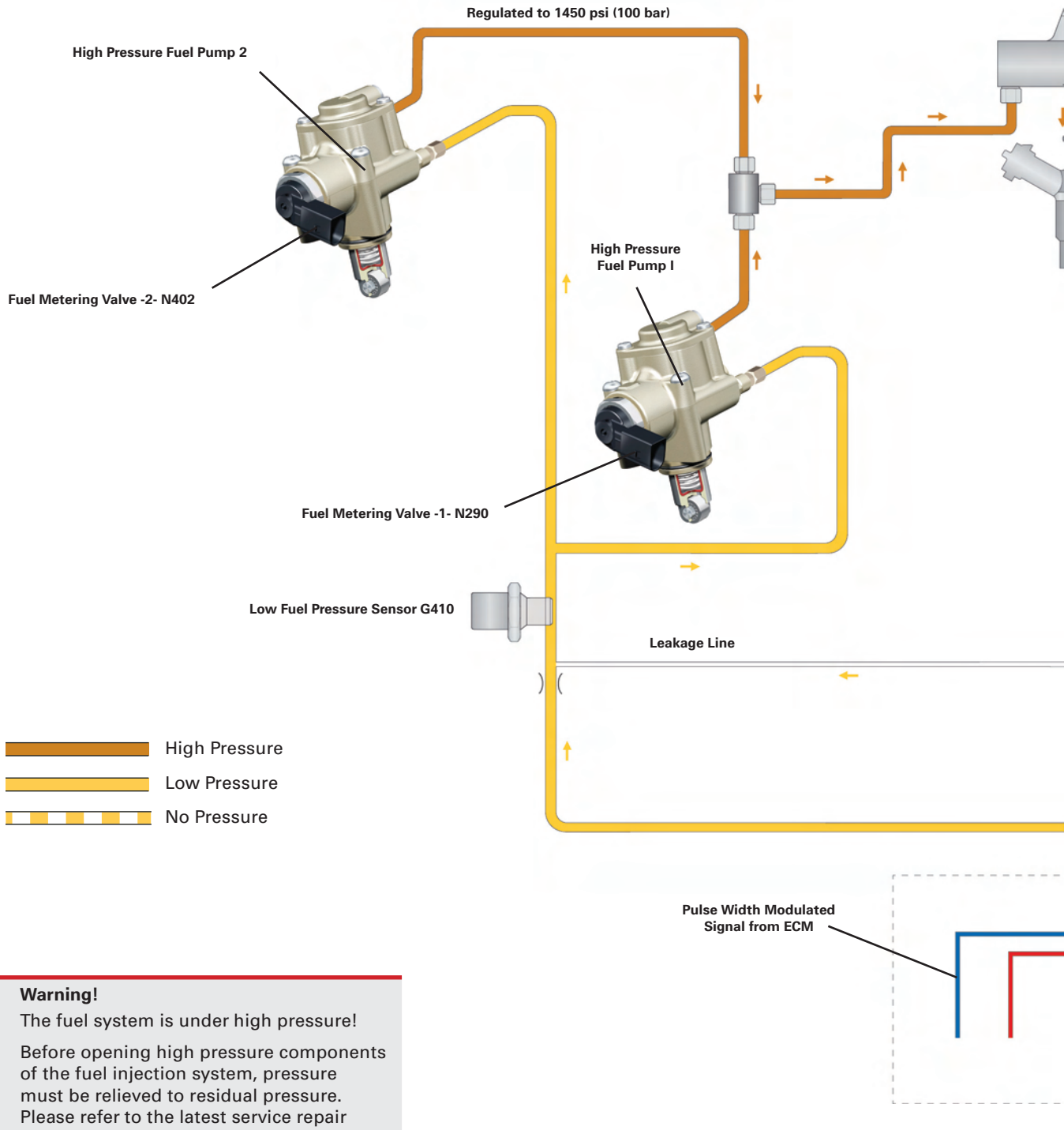
Long Intake Path: Change-Over Flaps Closed



The Intake Manifold Length When in the Torque Position (longer path) is 26.6 in (675 mm)

In the middle load and RPM ranges, the intake manifold is switched to the long intake runners. This provides better cylinder filling.

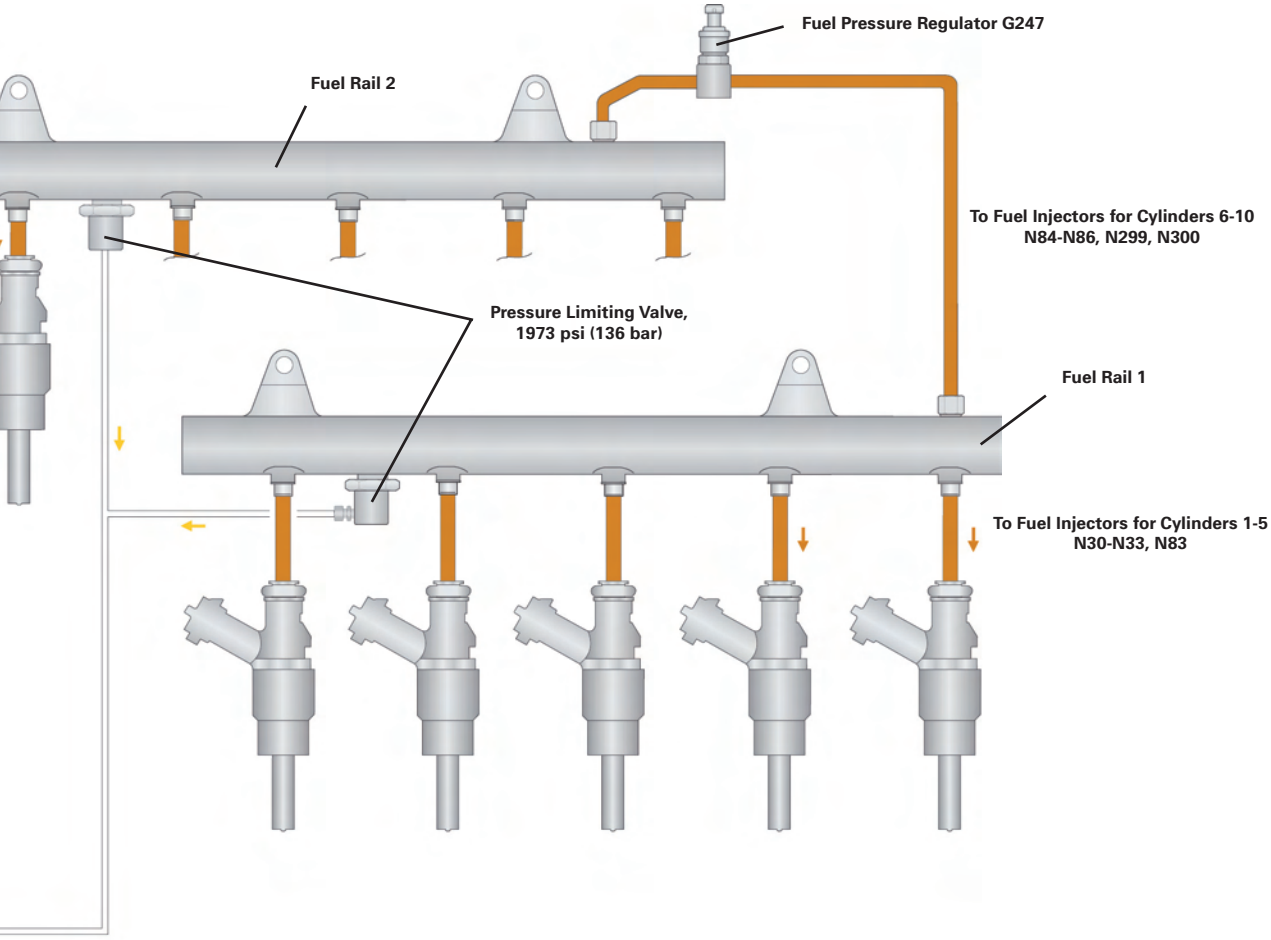
Fuel System (S8)

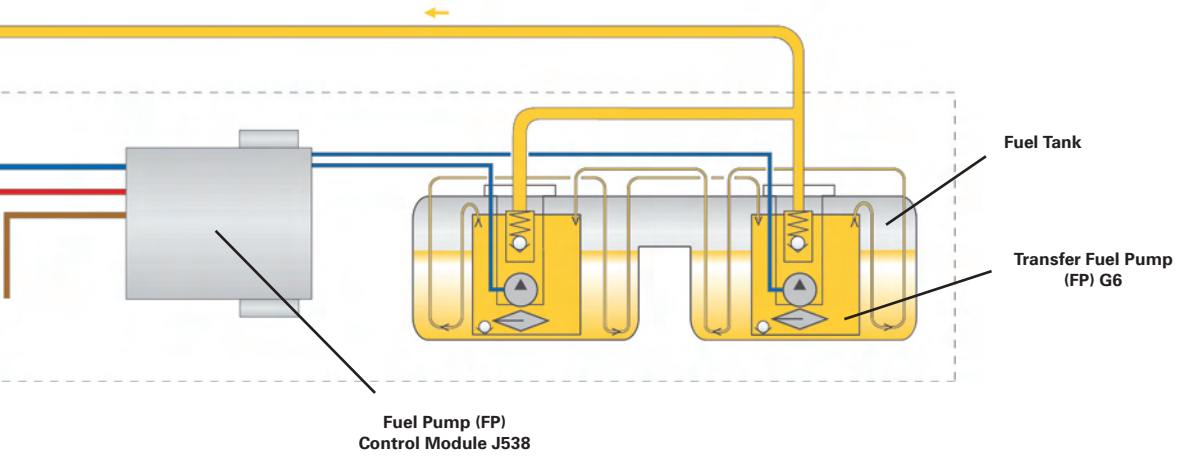


Warning!

The fuel system is under high pressure!

Before opening high pressure components of the fuel injection system, pressure must be relieved to residual pressure. Please refer to the latest service repair information.


Fuel Pressure Regulator G247
Fuel Rail 2
To Fuel Injectors for Cylinders 6-10
N84-N86, N299, N300
Pressure Limiting Valve,
1973 psi (136 bar)
Fuel Rail 1
To Fuel Injectors for Cylinders 1-5
N30-N33, N83

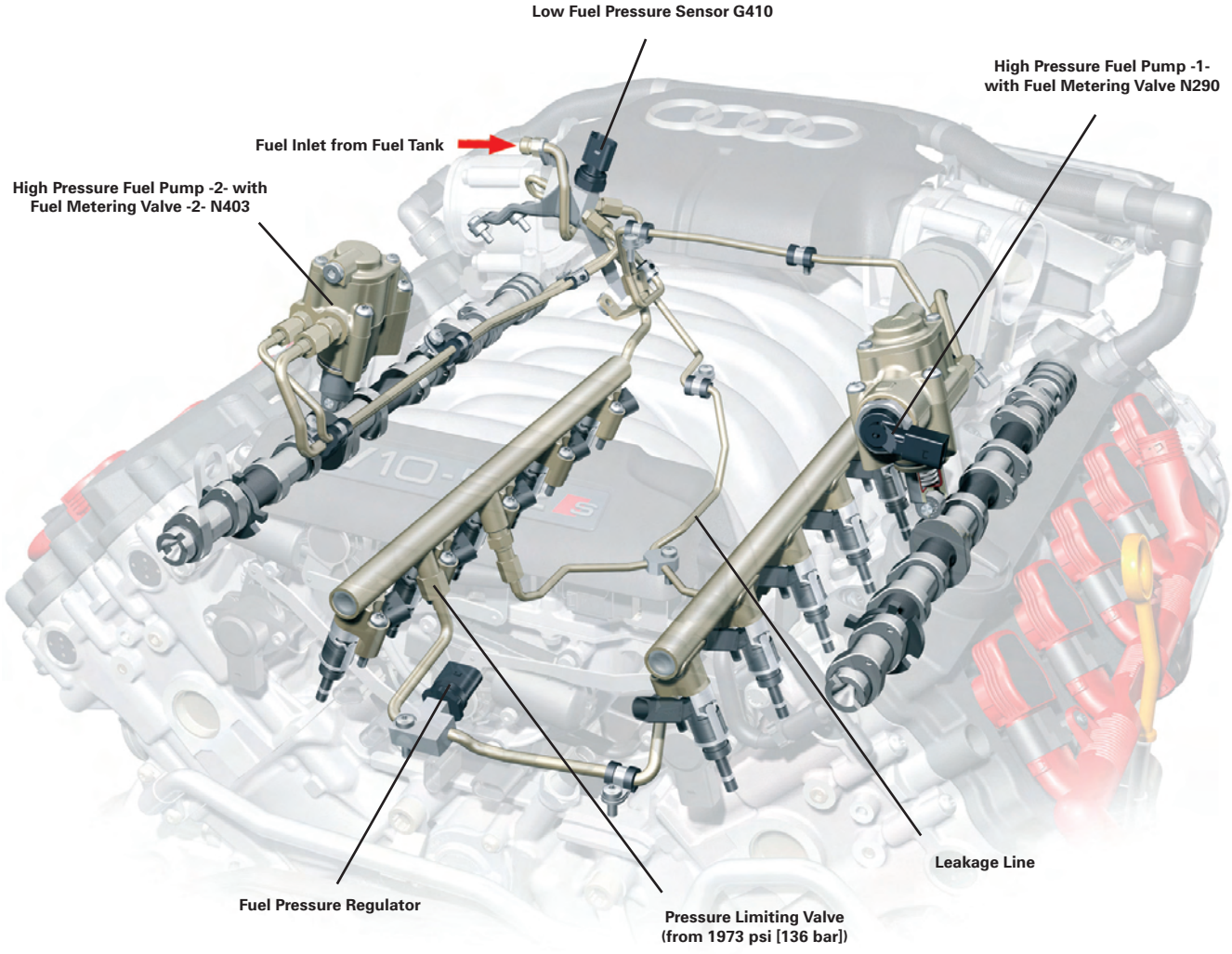

Fuel Tank
Transfer Fuel Pump
(FP) G6
Fuel Pump (FP)
Control Module J538

Fuel Delivery

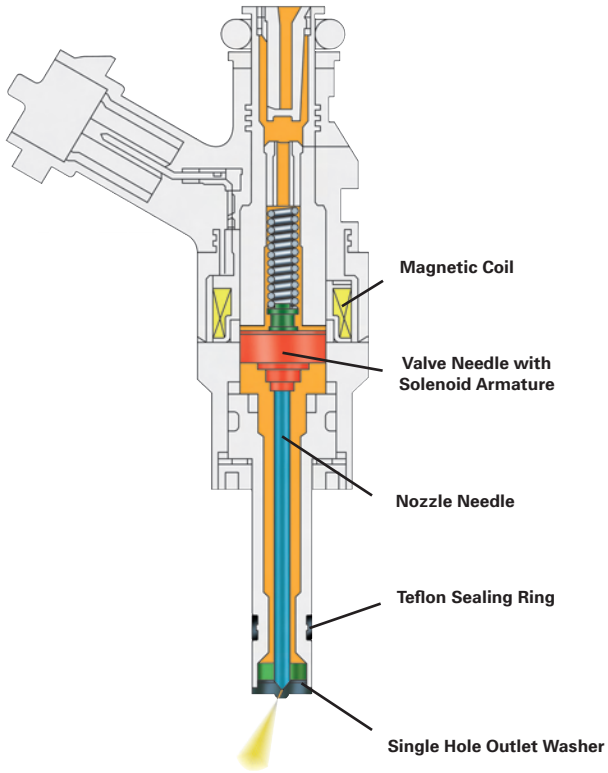
High Pressure Circuit

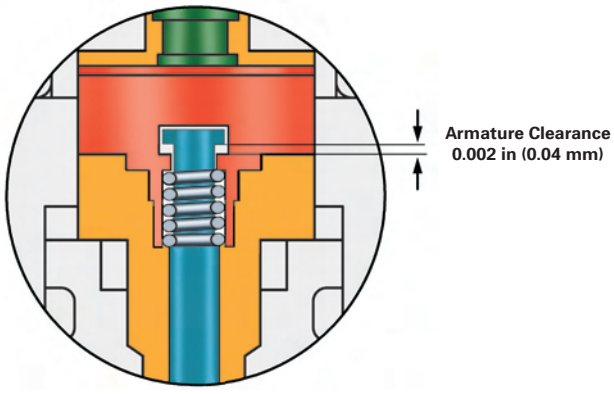
Fuel delivery to the 5.2L V10 FSI engine is similar to other FSI engines. The fuel system can be divided into low pressure and high pressure circuits. In the low pressure circuit, fuel is delivered by in-tank, demand regulated fuel pumps. The fuel is delivered to two high pressure fuel pumps, one located on each cylinder bank. The single piston high pressure pumps are driven by special lobes on the intake valve camshafts. Each pump has an electronically controlled metering valve.

The fuel pressure is raised by the high pressure pumps from approximately 87 psi (6.0 bar) of the return-free system to approximately 1450 psi (100 bar) before it is delivered to the fuel rails for each cylinder bank. The use of fuel rails reduces pulsation of the fuel. The pumps do not deliver fuel simultaneously but in an alternating manner.



The solenoid operated fuel injectors are controlled by the engine control module and open at approximately 65 volts. They are a single hole design installed at an angle of 7.5°. This installation angle ensures the injection stream will not aimed at the cylinder walls. The injectors have teflon sealing rings that must be replaced if the injectors are removed and re-installed.



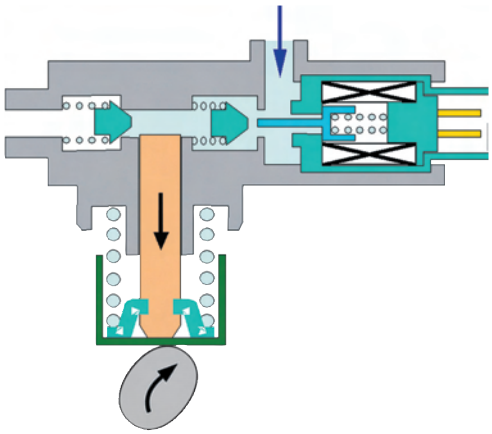


Pump Operation



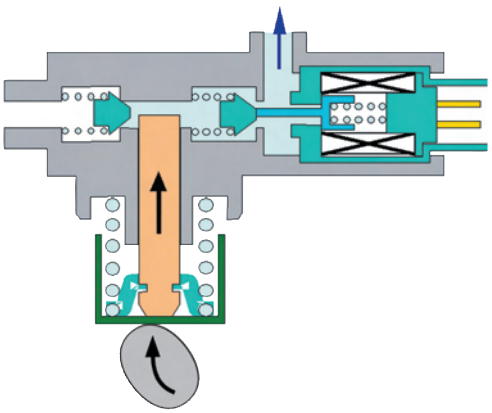
Intake Stroke

The shape of the cam and the force of the piston springs move the pump piston downward. The increased space inside of the pump causes the fuel to flow in. Fuel Metering Valve N290 ensures that the low pressure valve remains open. Fuel Metering Valve N290 is de-energized.



Useful Stroke

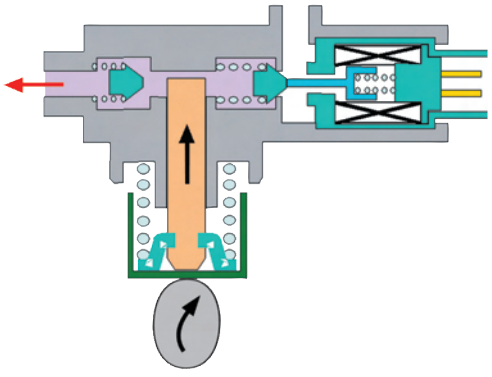
The cam moves the pump piston upward. Pressure still cannot be built up because Fuel Metering Valve N290 is de-energized. This prevents the low-pressure inlet valve from closing.



Pressure Stroke

Engine Control Module J623 now supplies current to the Fuel Metering Valve. The magneto armature is drawn up.

The pressure inside the pump presses the low-pressure inlet valve into its seat. If the pressure inside the pump exceeds the rail pressure, the return valve is pushed open and fuel is delivered to the rail.



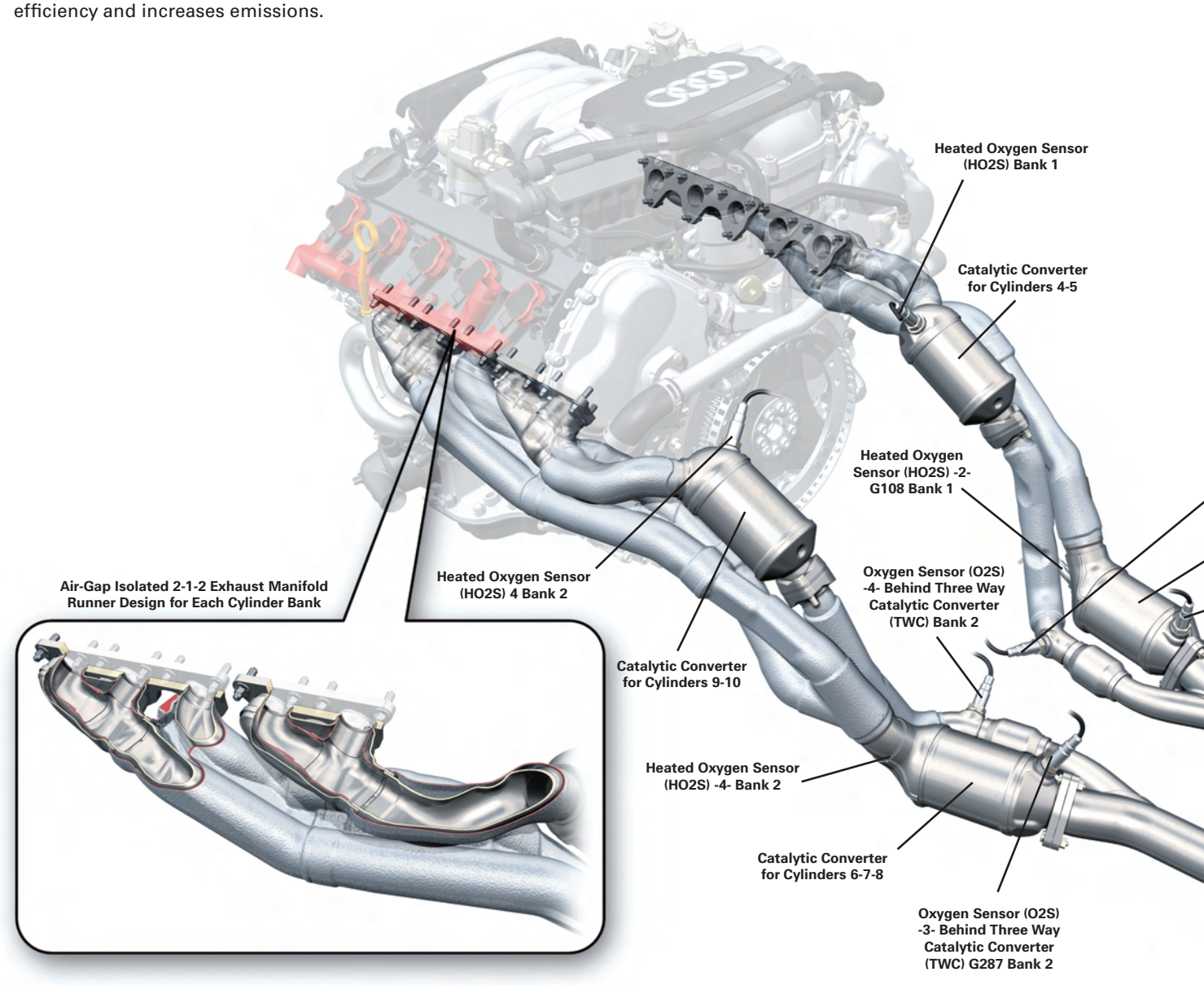
Notes

Exhaust Manifold

A V10 engine with a 90° cylinder bank angle creates the same demands on exhaust system design as a 5-cylinder engine. Each bank of the engine has an interval of 144° between adjacent cylinder ignition points. This leads to an over-lap of 210° of the exhaust valve openings.

The ignition intervals and consequent exhaust valve overlap can, in the worst case, create reverse pulsating waves in the exhaust manifold. These reverse waves inhibit both the scavenging of exhaust gas from the combustion chamber after combustion and the intake of fresh fuel mixture. This in turn reduces combustion efficiency and increases emissions.

To overcome this phenomenon, a special exhaust manifold design is required in which the exhaust ports of each cylinder are mated to each other in a specific manner. In the V10, a 2-1-2 manifold runner design is used.



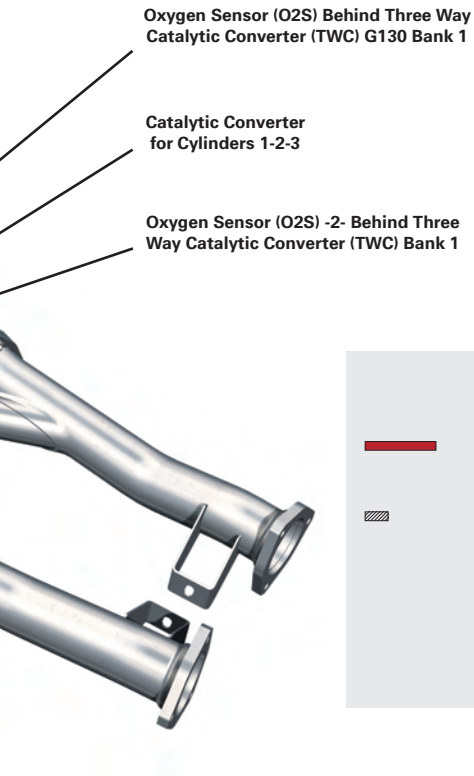
One solution to the exhaust gas pulsation phenomenon would be to make an exhaust manifold runner for each cylinder — a 5 into 1 header type system. However, this system would be big and would create a thermal disadvantage to the quick warming of the emission required catalytic converters.

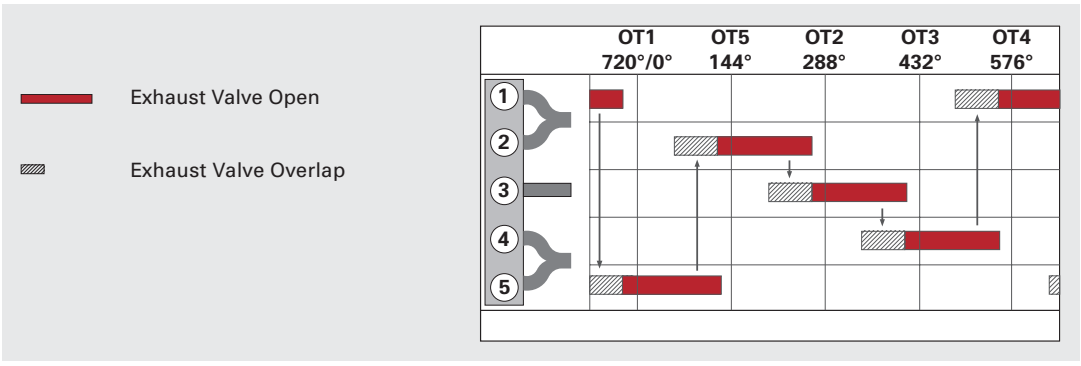
The exhaust ports for each bank of five cylinders are joined to three exhaust manifold runners. The mating of the exhaust runners for the cylinders was determined by their sequence in the firing order.

On the left bank, the runners for cylinders 6 and 7 are joined into one exhaust runner — cylinders 9 and 10 into another. The exhaust port for cylinder 8 is a separate runner. The manifold runners for cylinders 6, 7, and 8 are joined to one catalytic converter while the exhaust runners for cylinders 9 and 10 are joined to another.

On the right bank, the runners for cylinders 1 and 2 are joined into one exhaust runner — cylinders 4 and 5 into another. The exhaust port for cylinder 3 is a separate runner. The manifold runners for cylinders 1, 2, and 3 are joined to one catalytic converter while the exhaust runners for cylinders 4 and 5 are joined to another.

Post-combustion exhaust gas treatment is done by four ceramic catalytic converters. Because the two catalytic converters for each bank service unequal numbers of cylinders, they are different in size.





Bosch MED 9.1 System (S8)

Sensors

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

Throttle Position (TP) Sensor G79
Accelerator Pedal Position Sensor -2- G185

Engine Speed (RPM) Sensor G28

Knock Sensors (KS) -1+2- G61, G66

Fuel Pressure Sensor G247

Camshaft Position (CMP) sensor G40
Camshaft Position (CMP) Sensor -3- G300

Throttle Valve Control Module J338
Throttle Drive Angle Sensors -1+2- (for electronic power control [EPC]) G187, G188

Engine Coolant Temperature (ECT) Sensor G62

Low Fuel Pressure Sensor G410

Intake Manifold Runner Position Sensor G336

Heated Oxygen Sensor (HO2S) G39; Oxygen Sensor (O2S) Behind 3-Way Catalytic Converter (TWC) G130
Heated Oxygen Sensor (HO2S) -2- G108; Oxygen Sensor (O2S) -2- Behind 3-Way Catalytic Converter (TWC) G131

Brake Booster Pressure Sensor G294

Brake Light Switch F
Brake Pedal Switch F47

Additional Signals:
- Cruise Control ON/OFF
- Park/Neutral Signal
- Terminal 50
- Wake Up Signal from Driver's Door Switch via J393

Mass Air Flow (MAF) Sensor -2- G246

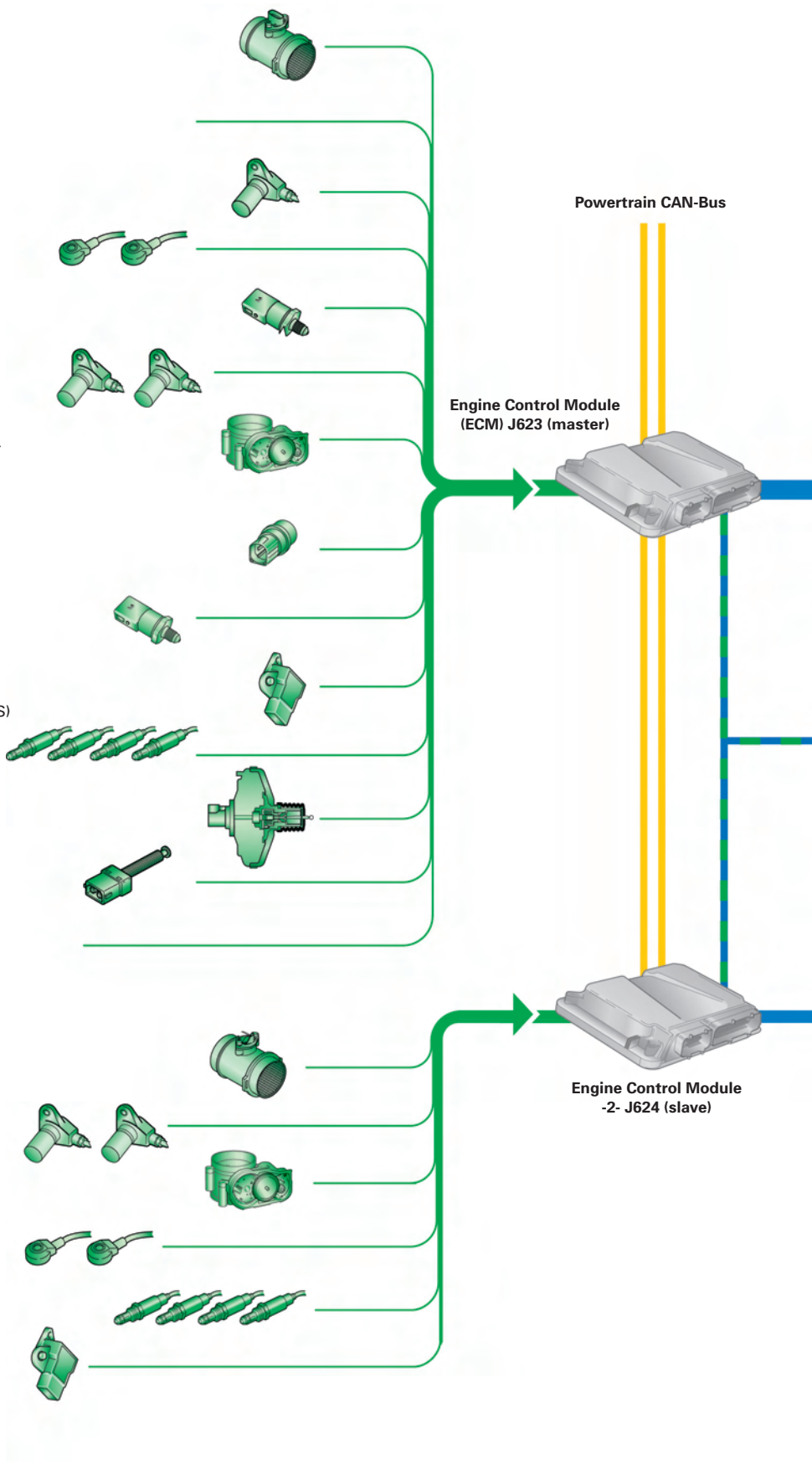
Camshaft Position (CMP) Sensor -2- G163
Camshaft Position (CMP) Sensor -4- G301

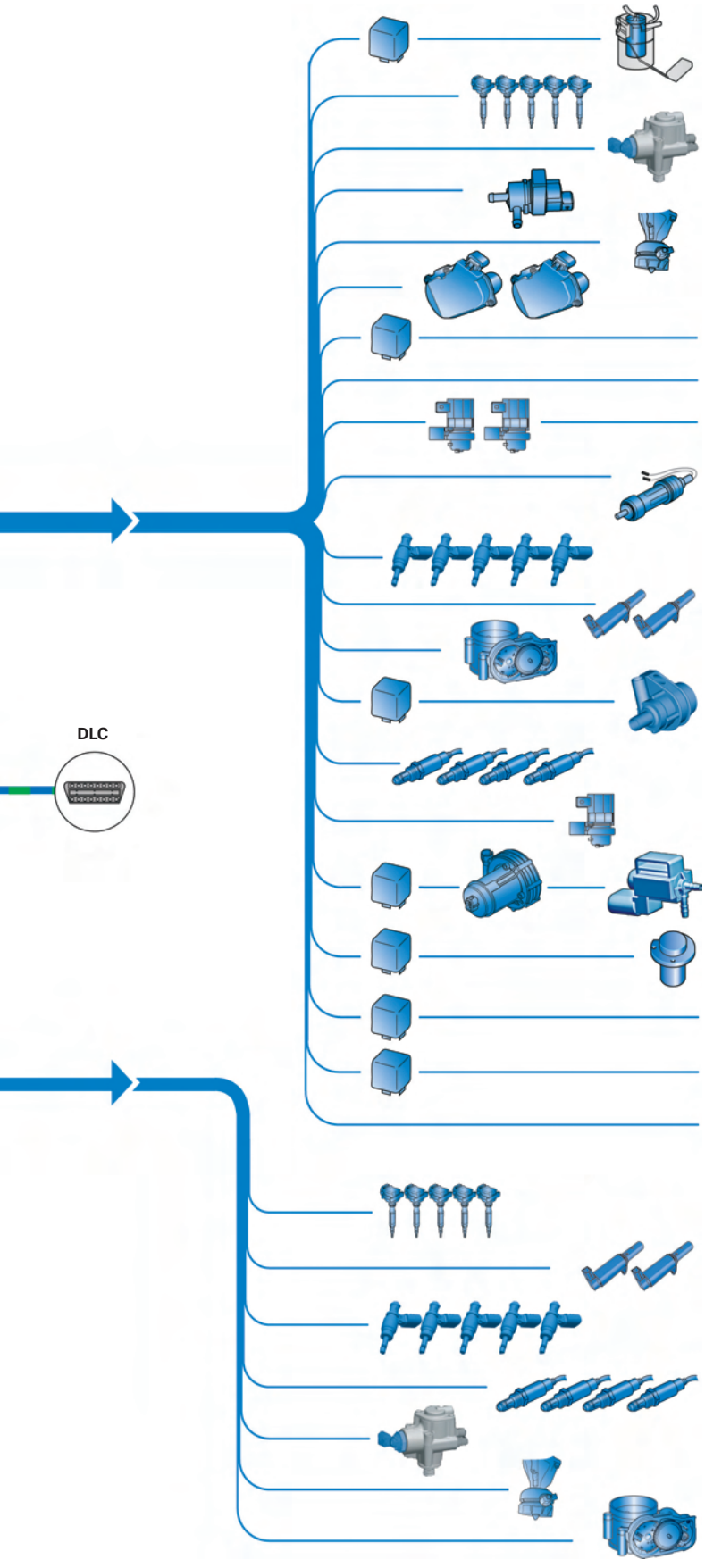
Rear Wing Height Adjustment Left Sensor -2- J544
Throttle Drive Angle Sensors -1+2- G297, G298

Knock Sensors -3- and -4- G198, G199

Heated Oxygen Sensor (HO2S) -3- G285; Oxygen Sensor (O2S) -3- Behind 3-Way Catalytic Converter (TWC) G287
Heated Oxygen Sensor (HO2S) -4- G286; Oxygen Sensor (O2S) -4- Behind 3-Way Catalytic Converter (TWC) G288

Intake Manifold Runner Position Sensor -2- G512





Actuators

Fuel Pump (FP) Control Module J538
Transfer Fuel Pump (FP) G6

Ignition Coils -1+2+3+5- with Power Output Stage N70, N291, N292, N323
Cylinders 1-5

Fuel Metering Valve N290

Evaporative Emission (EVAP) Canister Purge Regulator Valve N80

Right Electro-Hydraulic Engine Mount Solenoid Valve N145

Intake Flap Motor V157
Variable Intake Manifold Runner Motor V183

Starter Relay J53
Starter Relay -2- J695

Leak Detection Pump (LDP) V144

Exhaust Flap Valve -1- N321
Exhaust Flap Valve -2- N322

Map Controlled Engine Cooling Thermostat F265

Cylinders -1+2+3+4+5- Fuel Injectors N30-N33, N83

Camshaft Adjustment Valve -1- N205
Camshaft Adjustment Valve -1- (exhaust) N318

Throttle Drive (for electronic power control [EPC]) G186

Coolant Circulation Pump Relay J151
After-Run Coolant Pump V51

Oxygen Sensor (O2S) Heater Z19; Oxygen Sensor (O2S) -1- Behind 3-Way Catalytic Converter (TWC) Heater Z29; Oxygen Sensor (O2S) -2- Heater Z28
Oxygen Sensor (O2S) -2- Behind 3-Way Catalytic Converter (TWC) Heater Z30

Intake Air Switch-Over Valve N335

Secondary Air Injection (AIR) Pump Relay J299
Secondary Air Injection (AIR) Pump Motor V101
Secondary Air Injection (AIR) Solenoid Valve N112

Brake Booster Relay J569
Brake System Vacuum Pump V192

Engine Component Power Supply Relay J757

Motronic Engine Control Module (ECM) Power Supply Relay J271

Additional Signals:
– Coolant Fan Control (FC) Control Module J293
– Coolant Fan Control (FC) Control Module -2- J671

Ignition Coils -6+7+8+9+10- with Power Output Stage N324-N328
Cylinders 6-10

Camshaft Adjustment Valve -2- N208
Camshaft Adjustment Valve -2- Exhaust N319

Cylinders -6+7+8+9+10- Fuel Injectors N84-N86, N299, N300

Oxygen Sensor (O2S) -3- Heater Z62; Oxygen Sensor (O2S) -3- Behind 3-Way Catalytic Converter (TWC) Heater Z64; Oxygen Sensor (O2S) -4- Heater Z63
Oxygen Sensor (O2S) -4- Behind 3-Way Catalytic Converter (TWC) Heater Z65

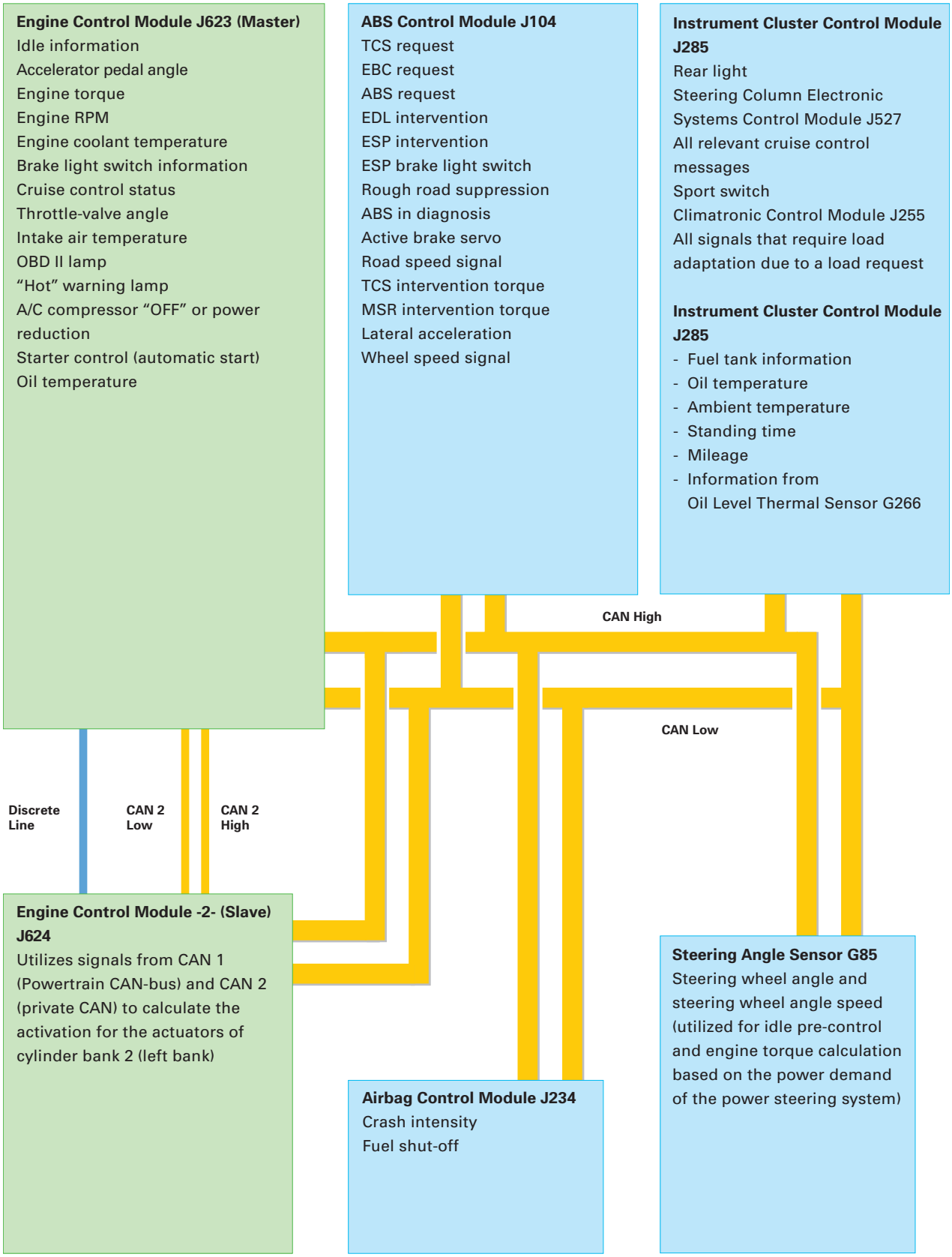
Fuel Metering Valve -2- N402

Left Electro-Hydraulic Engine Mount Solenoid Valve N144

Throttle Drive -2- G296

CAN-Bus Interface

Overview



Communication Between Engine Control Modules (Master/Slave)

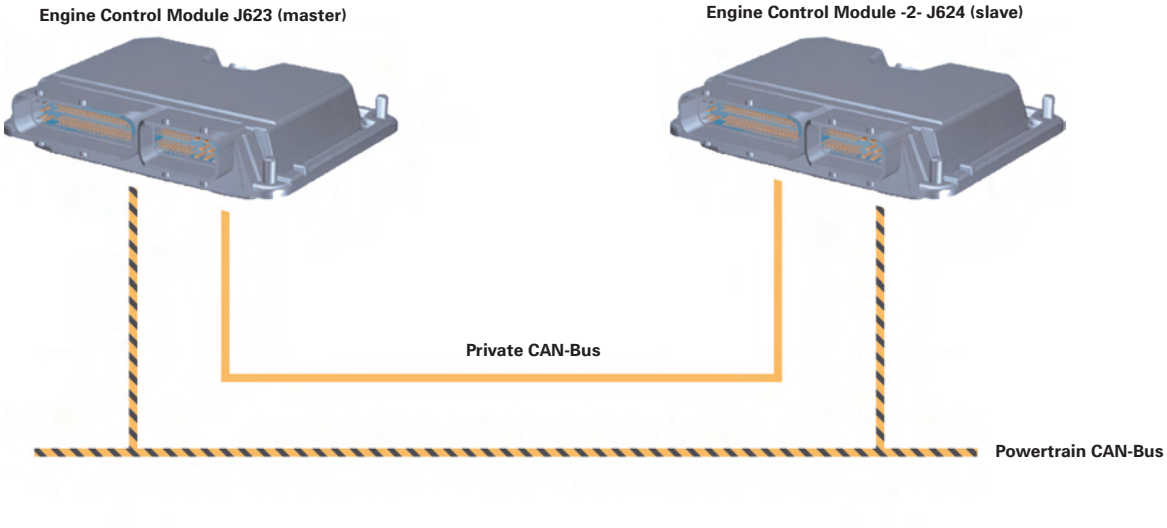
Engine Control Module J623 (Master ECM) and Engine Control Module -2- J624 (Slave) communicate with each other over a private CAN-bus. Both control modules are connected to the Powertrain CAN-bus and have the same part number. Determination of master or slave status depends on a pin coding of the modules during installation.

J623 monitors all system sensors and calculates necessary output signals. It also controls the actuators for cylinder bank 1.

J624 only receives signals from J623 and controls the actuators for cylinder bank 2. J624 has two other main functions. It processes the signal from Engine Speed Sensor G28 and monitors misfire detection for all 10 cylinders.

The ignition timing and fuel injection quantity of the individual cylinders is regulated during normal operation and especially during the start sequence.

This must be done because of the configuration of the exhaust manifold and catalytic converter system. Carefully controlling the mixture and ignition timing of each cylinder allows quick heating of the catalytic converters, yet prevents overheating the converters closest to the engine.



Notes

Knowledge Assessment

An on-line Knowledge Assessment (exam) is available for this SSP.

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

You can find this Knowledge Assessment at:

www.accessaudi.com

From the accessaudi.com homepage:

- Click on the “ACADEMY” Tab
- Click on the “Academy Site” Link
- Click on the ”CRC Certification” Link

For assistance, please call:

Audi Academy

Learning Management Center Headquarters

1-877-AUDI-LMC (283-4562)

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

Vorsprung durch Technik **www.audiusa.com**

923603

**All rights reserved.
Technical specifications
subject to change without
notice.**

**Audi of America, Inc.
3800 Hamlin Road
Auburn Hills, Michigan 48326**