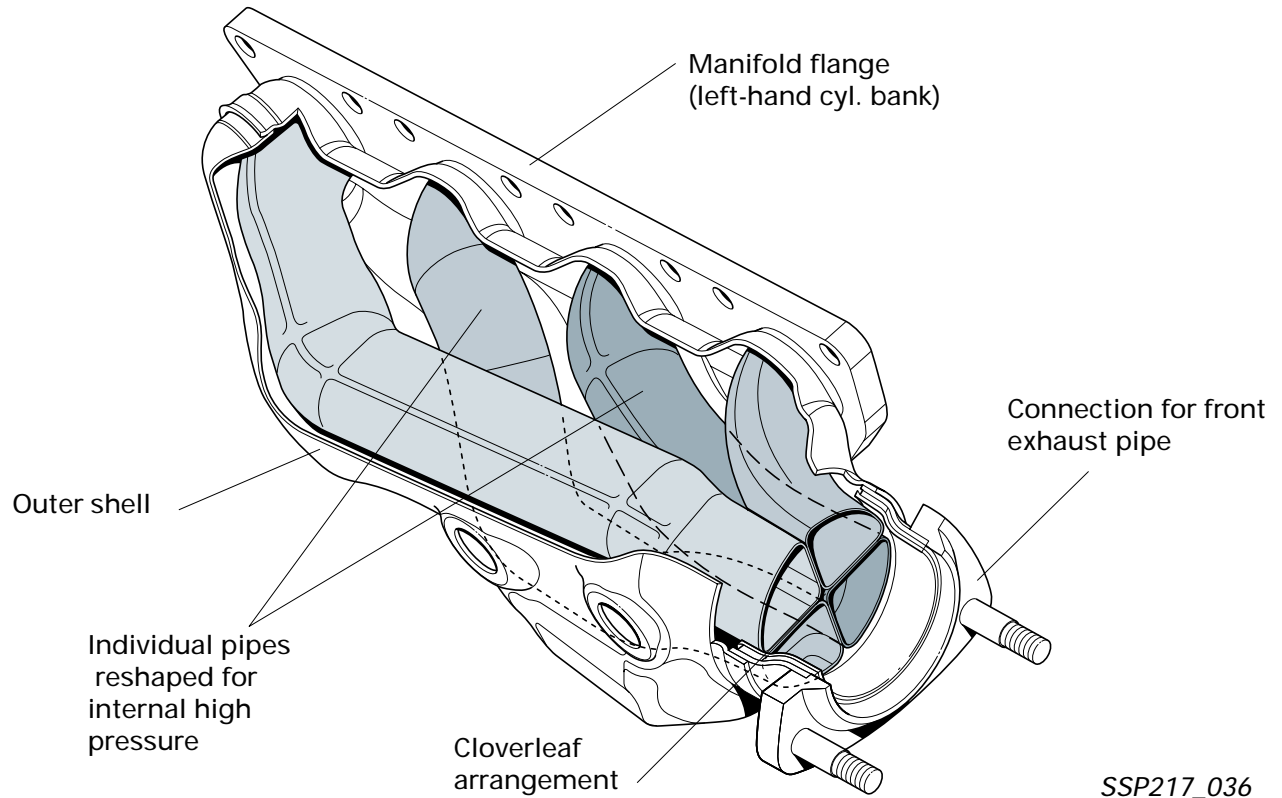


Engine - Mechanics

Exhaust manifold



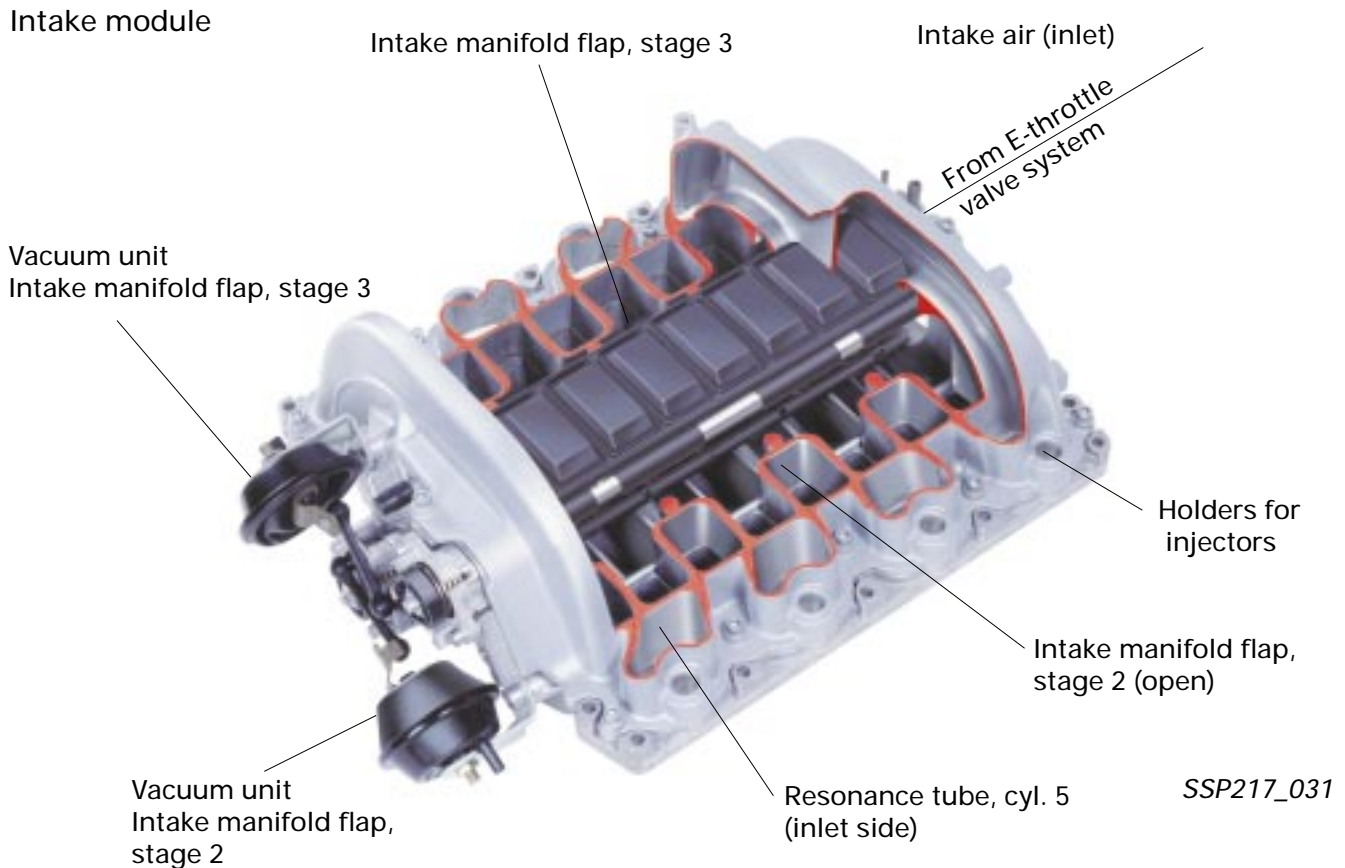
The pipe sections and assembly of the air-gap-insulated exhaust manifold have been modified.

The exhaust pipes of the individual cylinders are assembled in a cloverleaf configuration for each cylinder bank (4 in 1 arrangement).

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

Engine - Motronic Subsystems

Variable intake manifold



Increasing torque by means of variable intake manifolds is a tradition at Audi. A three-stage variable intake manifold made of a die-cast magnesium alloy, a further development of previous concepts, is to be used for the first time.

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 utilise the pulsations to optimum effect, the intake manifold flaps close the resonance tube openings by means of a circumferential, moulded-on sealing lip.



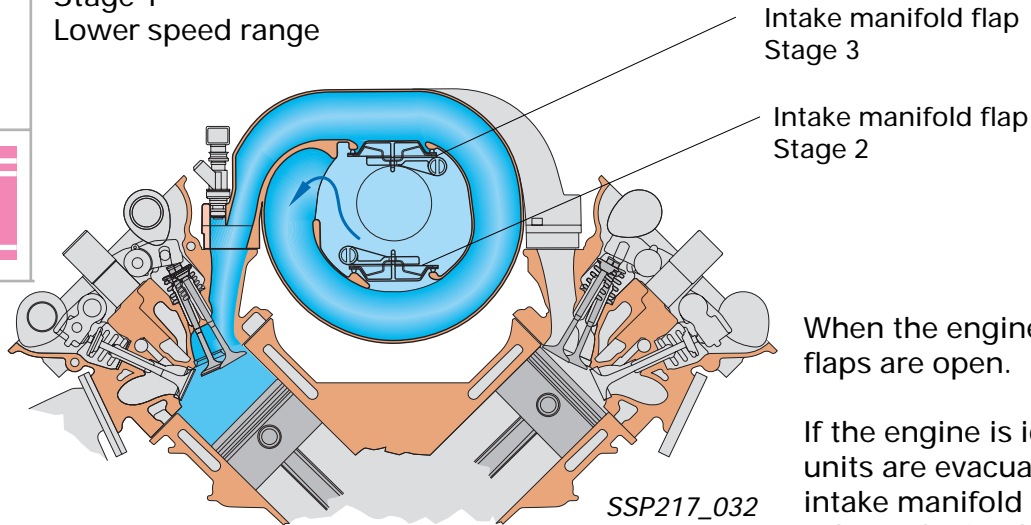
The variable intake manifold must not be dismantled. If necessary, the entire assembly must be completely replaced.



SSP217_030

Engine - Motronic Subsystems

Stage 1
Lower speed range



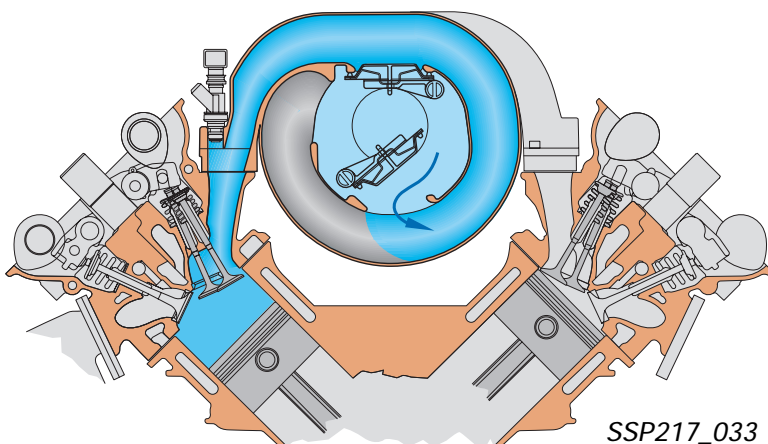
Intake manifold flap
Stage 3

Intake manifold flap
Stage 2

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

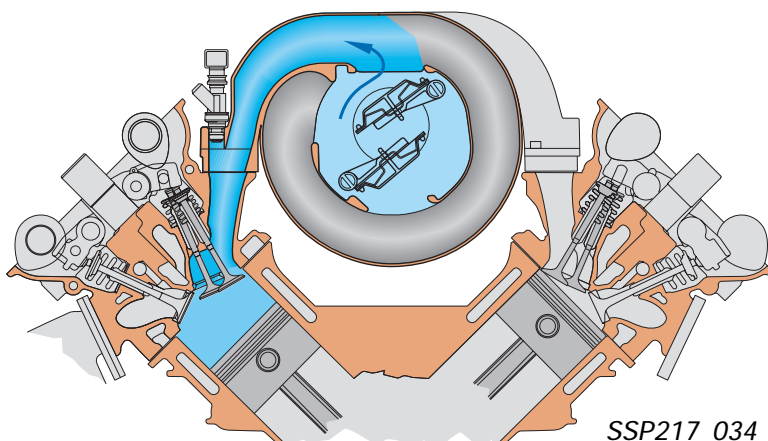
If the engine is idling, the two vacuum units are evacuated by the appropriate intake manifold changeover solenoid valves. The intake manifold flaps are, therefore, closed between the idling speed and the switching speed.

Stage 2
Middle speed range



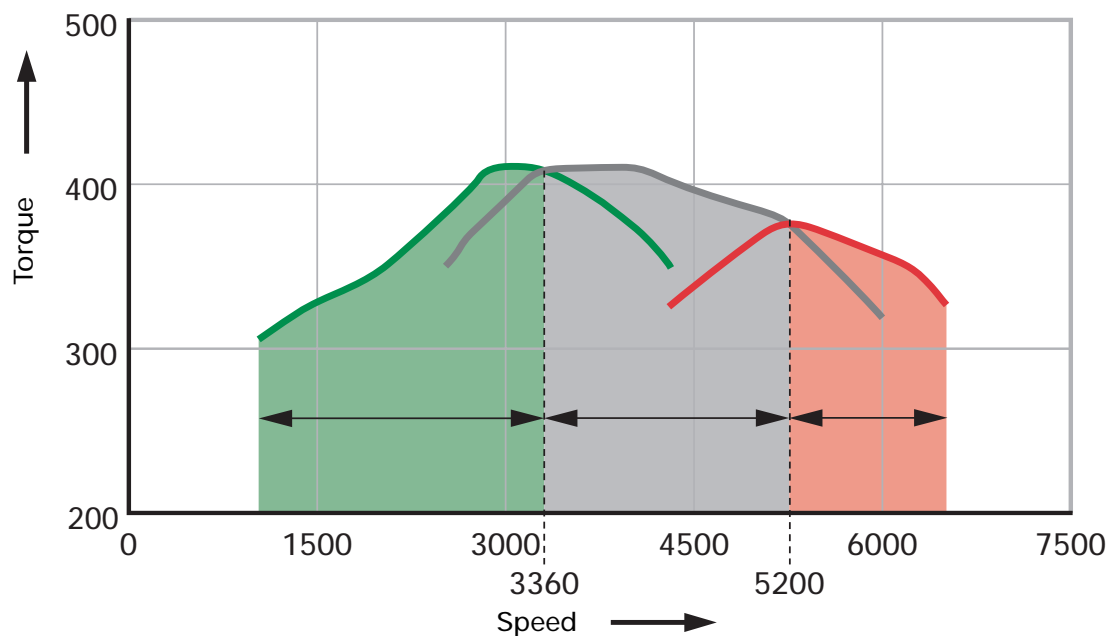
In the middle speed range, the intake manifold changeover solenoid valve N156 allows atmospheric pressure into the vacuum unit of the stage 3 intake manifold flap. The stage 2 intake manifold flap is opened and the intake path is shortened.

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



SSP217_035

- Lower full throttle (stage 1)
- Middle full throttle (stage 2)
- Upper full throttle (stage 3)

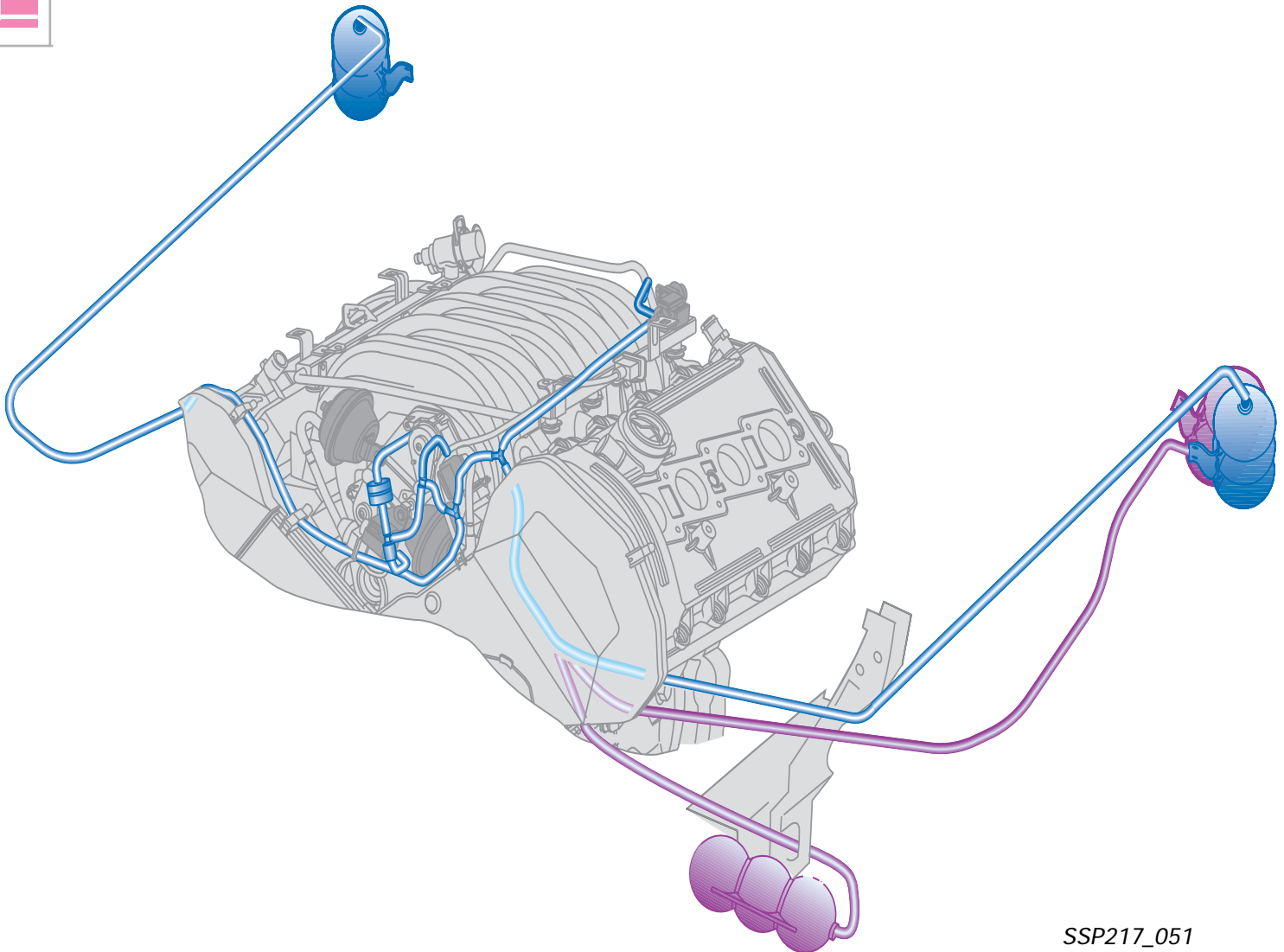
Since the maximum torque across the speed range depends primarily on the length and cross section of the intake manifold, the new three-stage variable intake manifold comes closest to producing the optimum characteristic torque curve across the speed range.

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


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 3 stages.


Engine - Motronic Subsystems

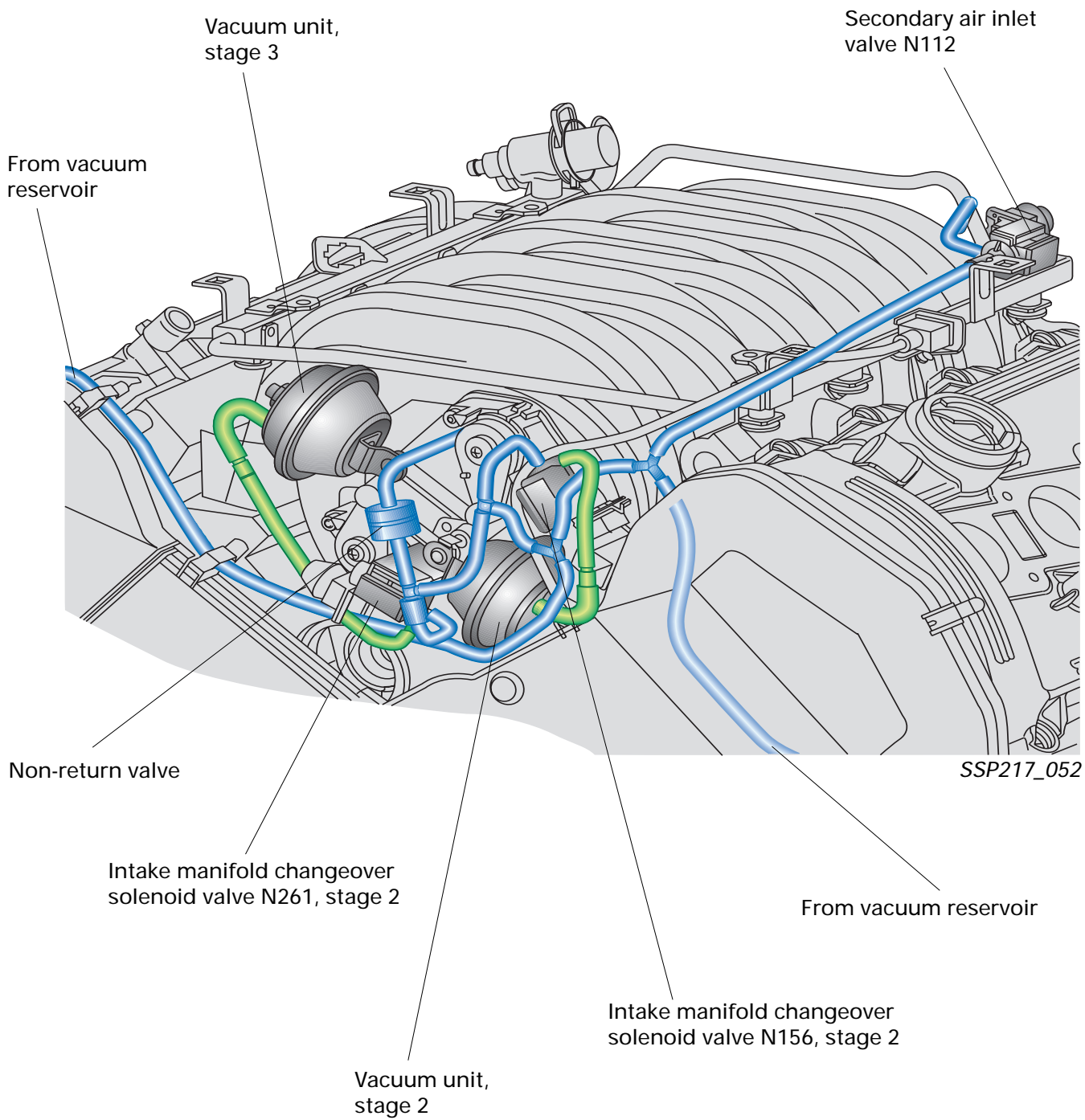
The vacuum required to control the variable intake manifold and the secondary air system is provided by two vacuum reservoirs. If a vacuum exists in the intake manifold, the reservoirs are evacuated via a non-return valve.



SSP217_051

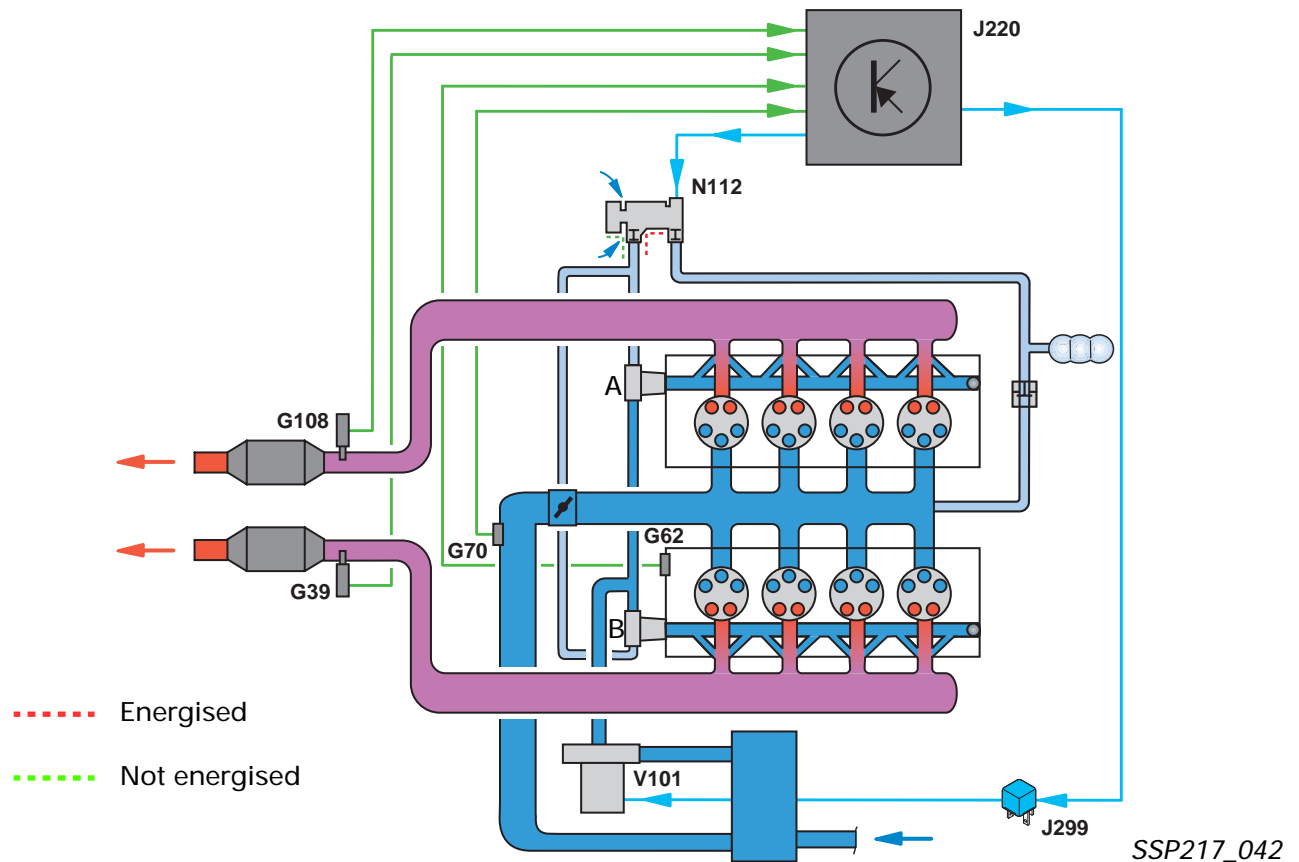
 Fitting location of vacuum reservoir,
Audi A8

 Fitting location of vacuum reservoir,
Audi A6



Engine - Motronic Subsystems

Secondary air system



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

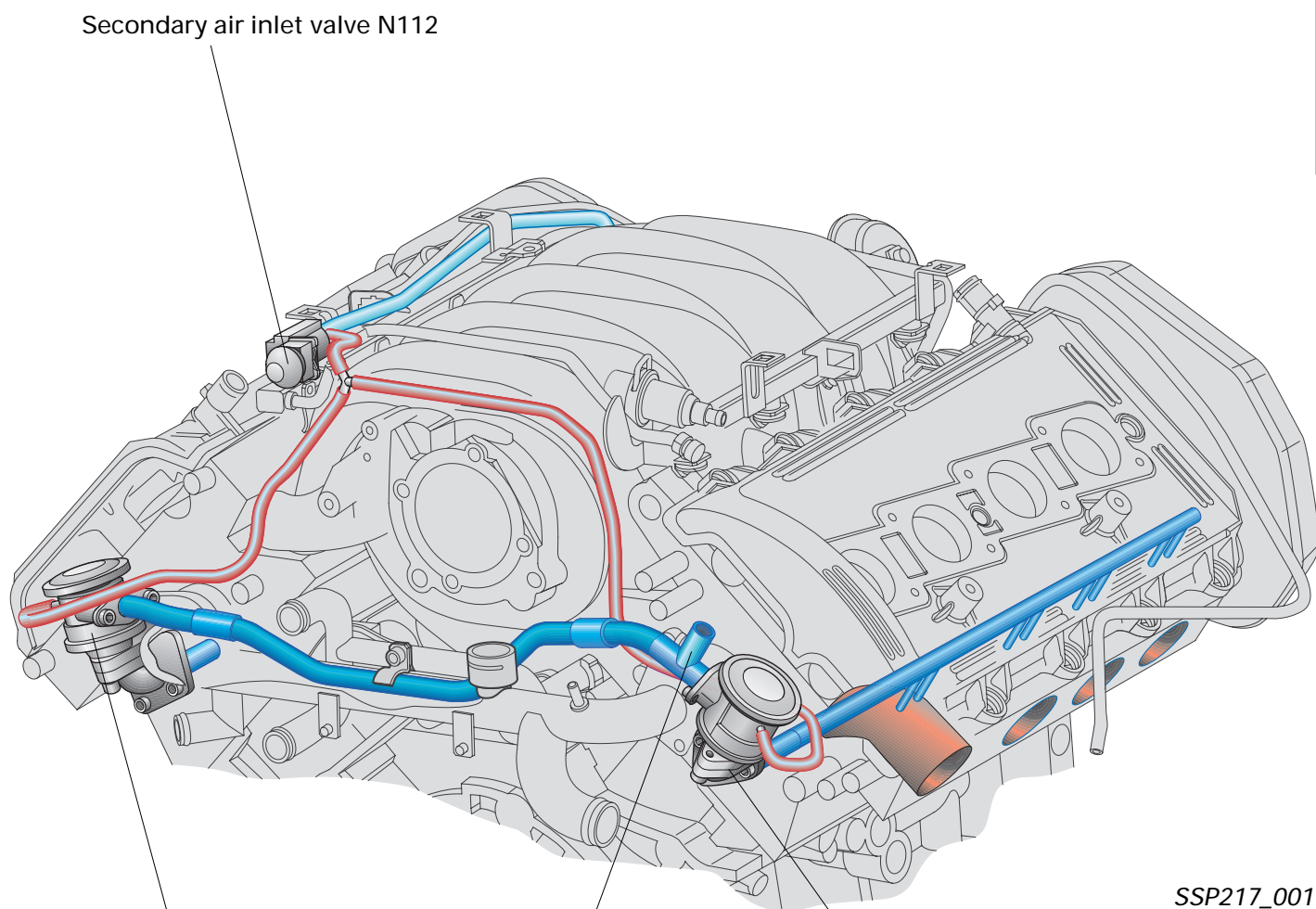
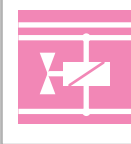
The catalytic converter cannot process this high proportion of hydrocarbons because:

1. the required operating temperature of the catalytic converter has not yet been reached and
2. a lambda 1 mixture must exist to allow complete conversion.

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

- the secondary air pump V101
- two combination valves A + B
- the secondary air inlet valve N112



SSP217_001

Combination valve
Cylinder bank 2

Connection for fresh air from
secondary air pump V101

Combination valve
Cylinder bank 1



Vacuum from engine



Control line (vacuum or atmospheric
pressure from secondary air inlet valve
N112)



Fresh air from secondary air pump
V101

Engine - Motronic Subsystems

Secondary air inlet valve N112

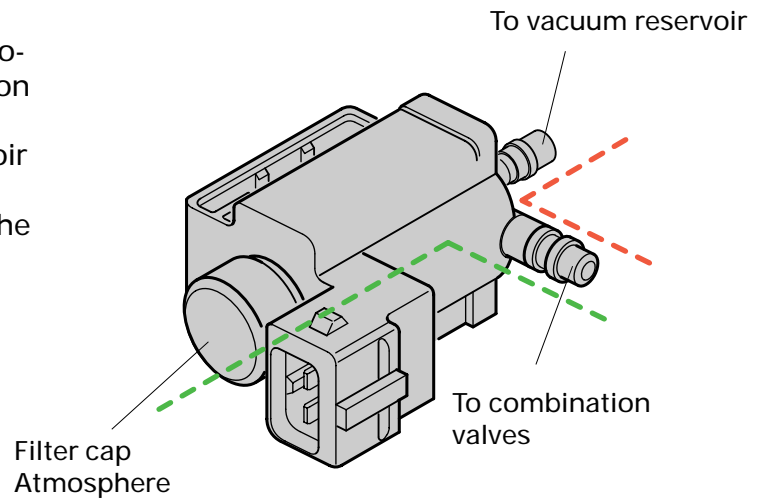
The secondary air inlet valve is an electro-pneumatic valve. It is activated by the Motronic control unit and controls the combination valve.

It releases the vacuum stored in the reservoir to open the combination valve.

Atmospheric pressure is released to close the combination valve.

..... Energised

..... Not energised

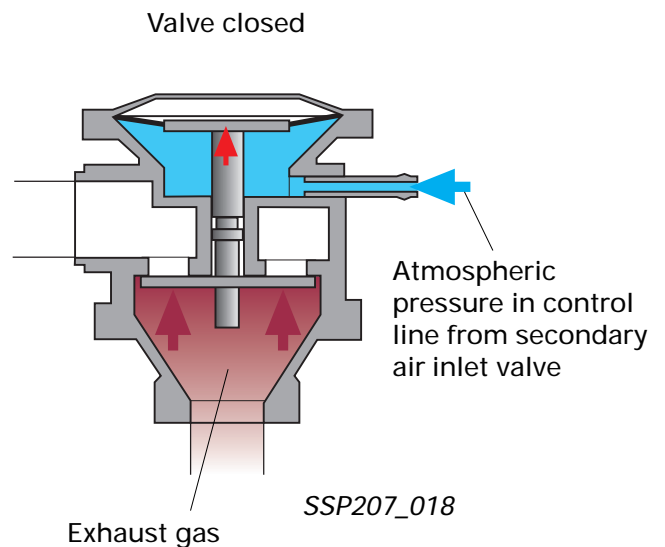
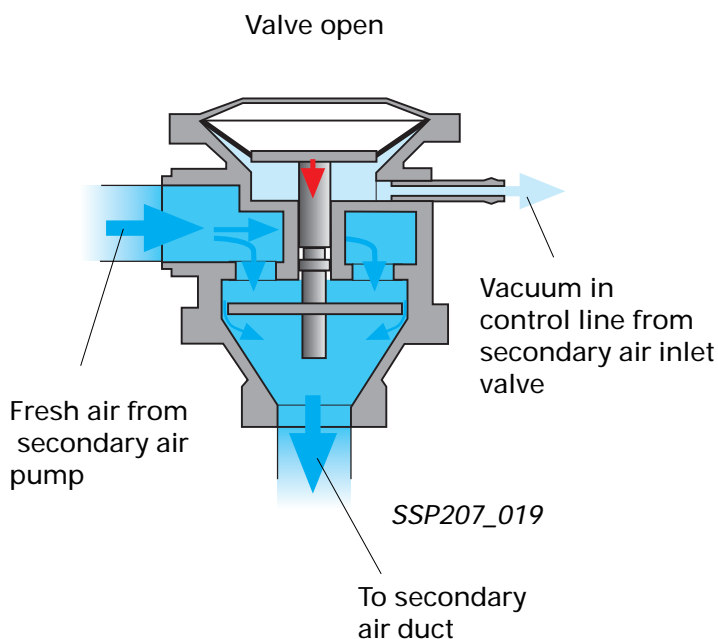


Combination valve

SSP207_016

The combination valve is bolted to the secondary air duct of the cylinder head. The vacuum from the secondary air inlet valve causes the air channel between the secondary air pump and the secondary duct of the cylinder head to open.

At the same time, the valve prevents hot exhaust gases from entering and then damaging the secondary air pump.



Secondary air pump V101

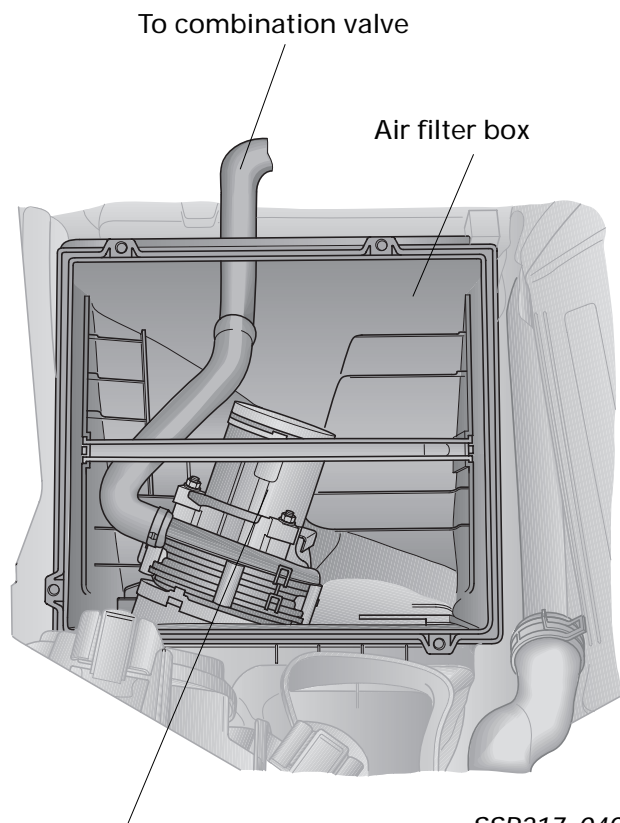
The secondary air pump relay J299 activated by the Motronic control unit connects the power supply for the secondary air pump motor V101. The fresh air mixed with the exhaust gas is drawn from the air filter housing by the secondary air pump and released by the combination valve.

The secondary air pump in the Audi A8 has its own air filter.
The pump is integrated in the air filter housing where it draws in unfiltered air.

The secondary air system is active at coolant temperatures between 0 and 55 °C.

The secondary air pump relay J299 and the secondary air inlet valve N112 are activated simultaneously.

The system is switched off after a defined air mass has been drawn in by the motor (information from the air mass meter).
At idling speed, this occurs after approx. 60 - 90 seconds.



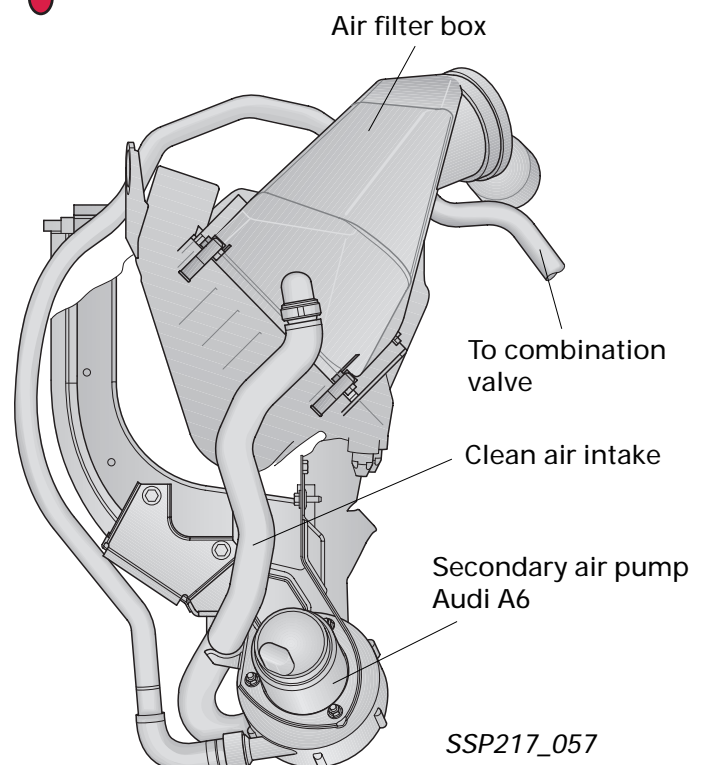
Secondary air pump,
Audi A8

SSP217_049



The secondary air system is described in SSP 207.

The secondary air pump in the Audi A6 does not have its own air filter. It is mounted to the longitudinal member and draws the filtered air from the air filter box.



SSP217_057

Engine Management

System overview

Motronic ME 7.1

Sensors

Hot-film air mass meter G70

Engine speed sender G28

Hall sender G40 (bank 2) and
Hall sender 2 G163 (bank 1)

Lambda probe G39 (bank 1) and
lambda probe G108 (bank 2)

Throttle valve control unit J338 with
throttle valve drive G186 (electric
throttle operation)
Angle sender -1- for throttle valve drive G187
Angle sender -2- for throttle valve drive G188

Coolant temperature sender G2 and G62

Knock sensor 1 G61 (bank 1) and
knock sensor 2 G66 (bank 2)

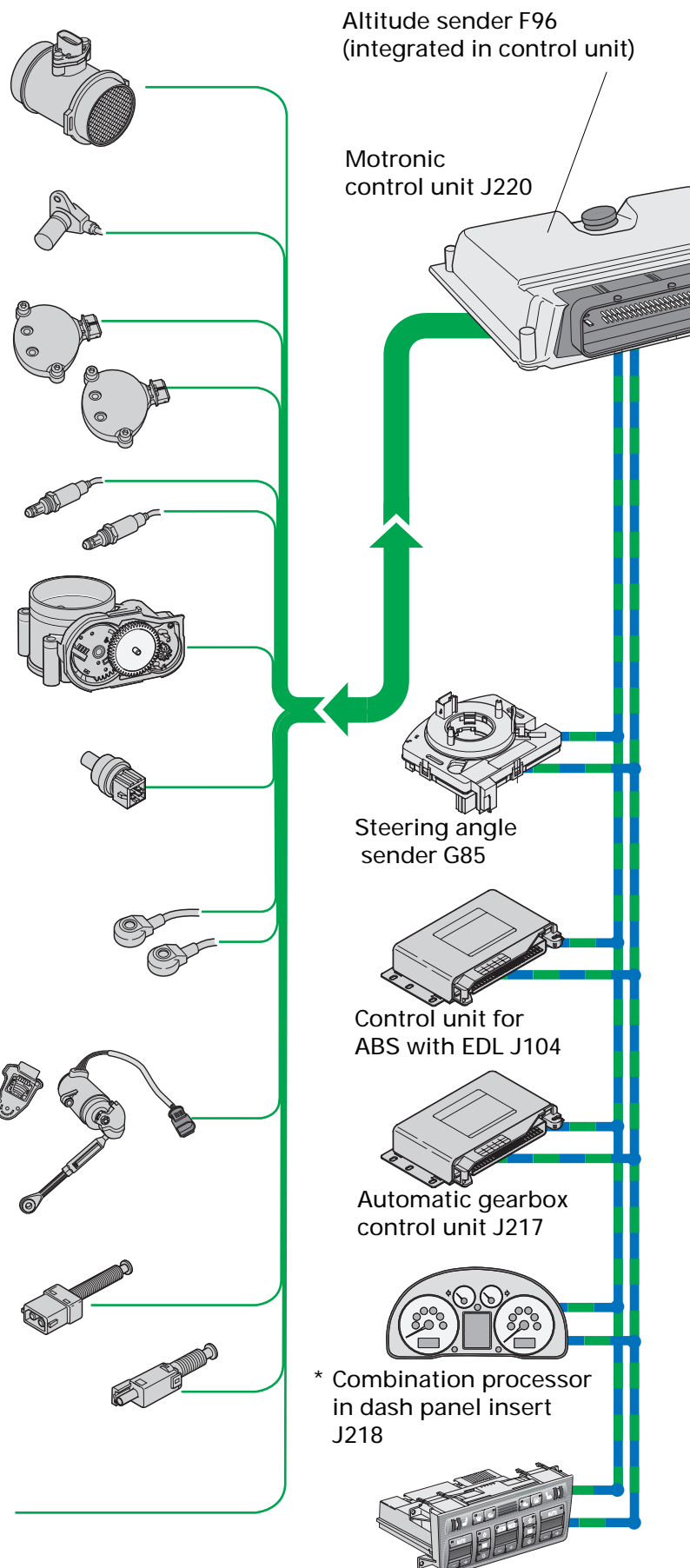
Pedal sender/accelerator pedal module with
accelerator pedal position sender (1) G79
and
accelerator pedal position sender (2) G185

Brake light switch F and
brake pedal switch F47

Clutch pedal switch F3
(with manual gearbox only)

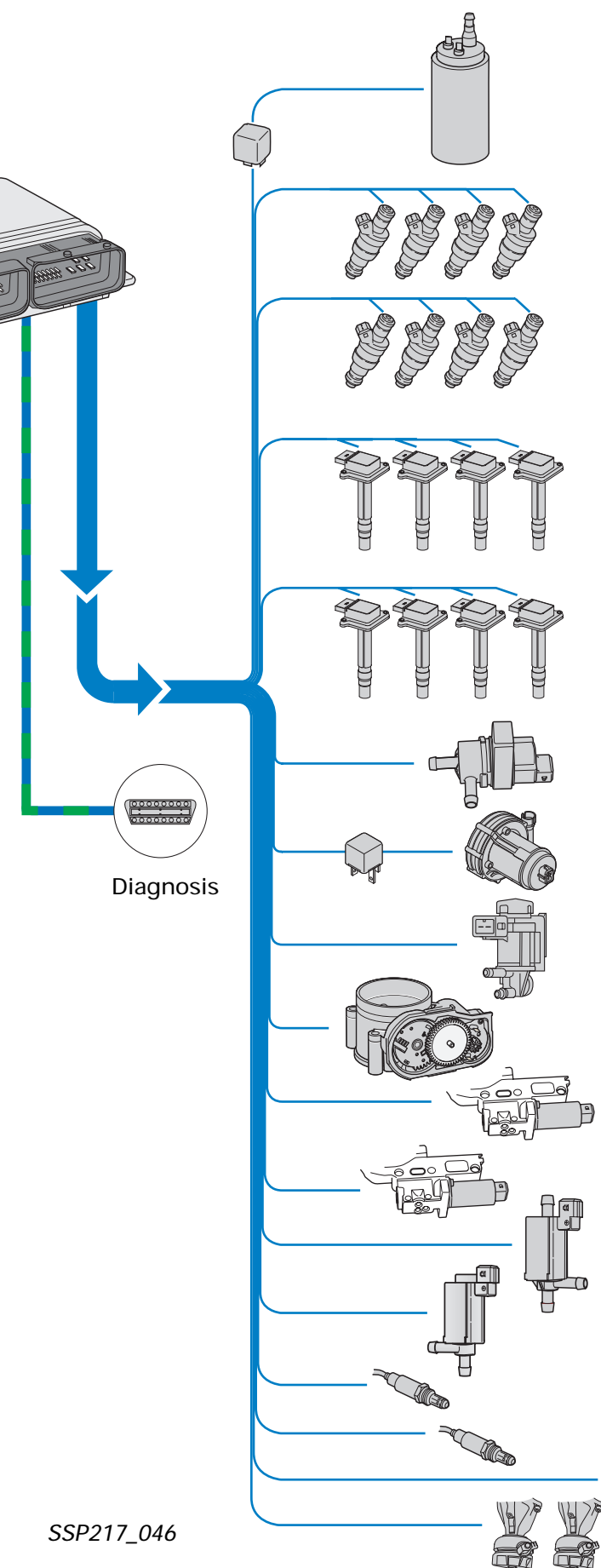
Additional signals

- Air conditioner requirement signal
- Air conditioner compressor,
bidirectional
- Crash signal
- CCS switch



* No CAN businterface
with Audi A6

* Air conditioner/Climatronic
operating and display unit
E87



Active components

Fuel pump relay J17 and
fuel pump G6

Injectors N30, N31, N32, N33
(bank 1)

Injectors N83, N84, N85, N86
(bank 2)

Ignition coil N (1st cyl.), N128 (2nd cyl.),
N158 (3rd cyl.), N163 (4th cyl.)

Ignition coil N164 (5th cyl.), N189 (6th cyl.),
N190 (7th cyl.), N191 (8th cyl.)

Activated charcoal filter system solenoid valve N80

Secondary air pump relay J299 and
secondary air pump motor V101

Secondary air inlet valve N112

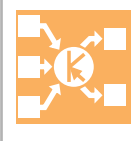
Throttle valve control unit J338
with throttle valve drive G186

Camshaft adjustment valve
N205 (bank 1) and N208 (bank 2)

Intake manifold changeover
valve N156
Intake manifold changeover
valve 2 N261

Lambda probe heating Z19 (bank 1) and
lambda probe heating Z28 (bank 2)

Additional signals
– Air conditioner compressor (out)
Engine mount 1 and 2





Engine Management


Function diagram


4.2/3.7 l in A8 GP


Colour coding

 = Input signal


 = Positive

 = Bidirectional

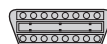
 = Output signal

 = Earth

Components

A	Battery	N144	Solenoid valve (left) for electro/hydraulic engine mounting
E45	Cruise control system switch	N145	Solenoid valve (right) for electro/hydraulic engine mounting
D	Ignition/starter switch	N156	Intake manifold changeover valve
F	Brake light switch	N158	Ignition coil 3
F36*	Clutch pedal switch (with manual gearbox only)	N163	Ignition coil 4
F47	Brake pedal switch for cruise control system	N164	Ignition coil 5
G2	Coolant temperature sender	N189	Ignition coil 6
G3	Coolant temperature gauge	N190	Ignition coil 7
G6	Fuel pump	N191	Ignition coil 8
G28	Engine speed sender	N205	Camshaft adjustment valve 1
G39	Lambda probe	N208	Camshaft adjustment valve 2
G40	Hall sender	N261	Intake manifold changeover valve 2
G61	Knock sensor 1	P	Spark plug connector
G62	Coolant temperature sender	Q	Spark plugs
G66	Knock sensor 2	S	Fuse
G70	Air mass meter	ST	Fuse holder
G79	Accelerator position sender	V101	Secondary air pump motor
G108	Lambda probe 2	Z19	Lambda probe heating
G163	Hall sender 2	Z28	Lambda probe heating 2
G185	Accelerator position sender 2	S204	Fitting location in Audi A6: plenum chamber next to battery
G186	Throttle valve drive (electric throttle operation)		Fitting location in Audi A8: top right in luggage compartment
G187	Angle sender 1 for throttle valve drive		
G188	Angle sender 2 for throttle valve drive		
J17	Fuel pump relay		
J220	Motronic control unit		
J299	Secondary air pump relay		
M9	Brake light bulb (left)		
M10	Brake light bulb (right)		
N	Ignition coil (cylinder 1)		
N30	Injector (cylinder 1)		
N31	Injector (cylinder 2)		
N32	Injector (cylinder 3)		
N33	Injector (cylinder 4)		
N80	Activated charcoal filter system solenoid valve		
N83	Injector (cylinder 5)		
N84	Injector (cylinder 6)		
N85	Injector (cylinder 7)		
N86	Injector (cylinder 8)		
N112	Secondary air inlet valve		
N128	Ignition coil 2		

Additional signals and connections



K diagnosis connection

①

Crash signal (in) from airbag control unit

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

}

Connections in function diagram

Engine Management

Quick-start functions

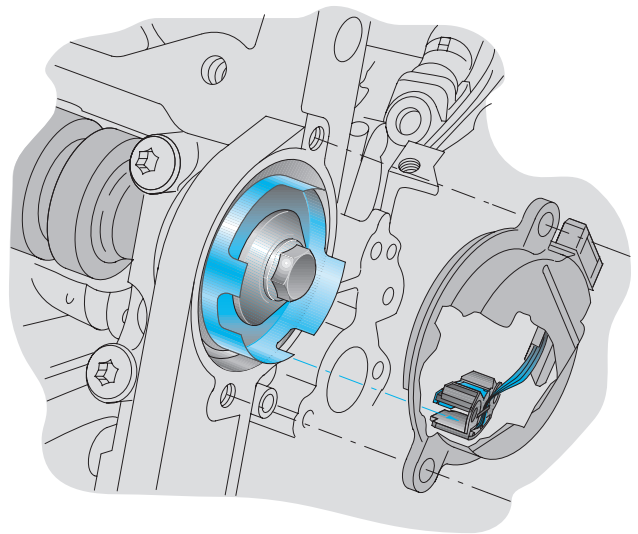
Camshaft position sensor G40 and G163

As with the V6-5V engines, the new V8-5V engines also have two sensors for determining the position of the camshaft (G40 and G163).

The sender system with "quick-start rotor ring" already used in the 4-cylinder 5-valve engines is implemented.

The quick-start rotor ring has two wide and two narrow stops (two small and two large windows).

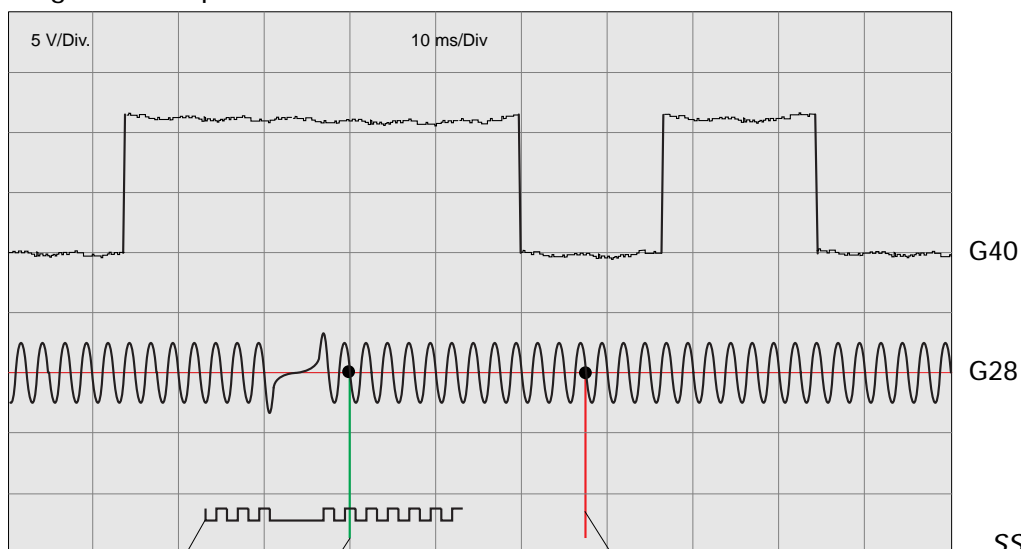
If a stop is in the Hall sensor, the level at the signal output sensor is high.



SSP217_053

Signal trace for engine speed sender G28 and Hall sender G40 using oscilloscope function of VAS 5051

Automatic mode



SSP217_062

Sender wheel

* Software reference mark
66° before TDC of 1st cylinder

TDC of 1st cylinder

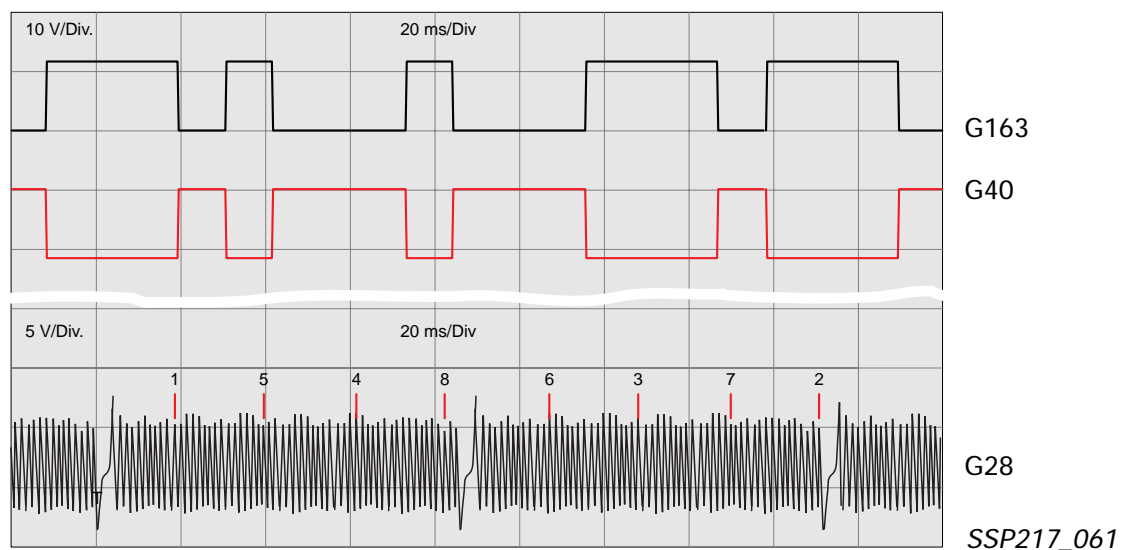
By using different stop widths, it is possible to use the signal from G40 together with the engine speed sender G28 to determine the camshaft position relative to the crankshaft more quickly.

When the engine is started, the engine control unit can thus determine the ignition TDC of the next cylinder more quickly so that the engine starts more quickly (synchronisation with the 1st cylinder is no longer necessary). This is referred to as quick-start synchronisation or the quick-start function.

* The software reference mark is the point from which the control unit commences its calculations to determine the ignition point. It is about one tooth after the hardware reference mark, which is approximately 66° - 67° cr./shaft before ignition TDC of the 1st cylinder.

Signal trace of engine speed sender G28, and Hall sender G40 and G163

Automatic mode



The camshaft position sensor G163 is used to monitor camshaft adjustment and to generate a substitute signal if the G40 fails.



The camshaft position sensor G40 is mounted to cylinder bank 2. The camshaft position sensor G163 is mounted to cylinder bank 1.

Engine run-down sensor

The ME 7.1 engine management system has an engine run-down sensor. This device supports the quick-start function so that fuel injection can occur before quick-start synchronisation.

The engine control unit remains active for a defined time after the ignition has been switched off and, with the aid of the G28, "monitors" the engine as it slows to a standstill.

The position of the engine mechanics (position of the next cylinder at ignition TDC) is stored and is available the next time the engine is started. The ME 7.1 can immediately begin injection and has a fuel mixture ready, which has a positive effect on starting behaviour.

Engine Management

The ME 7.1 engine management system has to a large extent been described in SSP 198. The new functions and features of the system used in the V8-5V engine are dealt with below.



Electronic throttle function

Apart the following features, the electronic throttle functions are identical to those described in SSP 198.

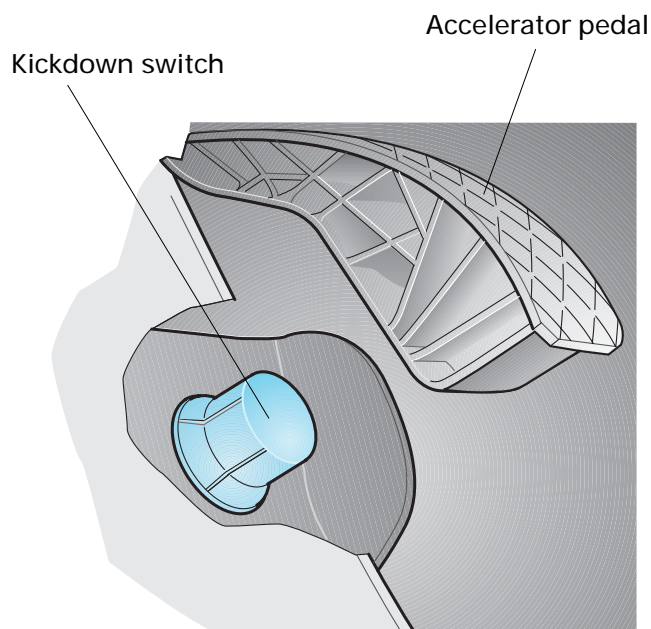
The pedal sender is used in the Audi A8 and the accelerator pedal module in the Audi A6 to determine the requirements of the driver.

Pedal sender (Audi A8)

A separate switch is used to provide kickdown information.

It is located in the footwell and doubles as the accelerator pedal stop.

The full-throttle and kickdown positions must be calibrated accordingly.

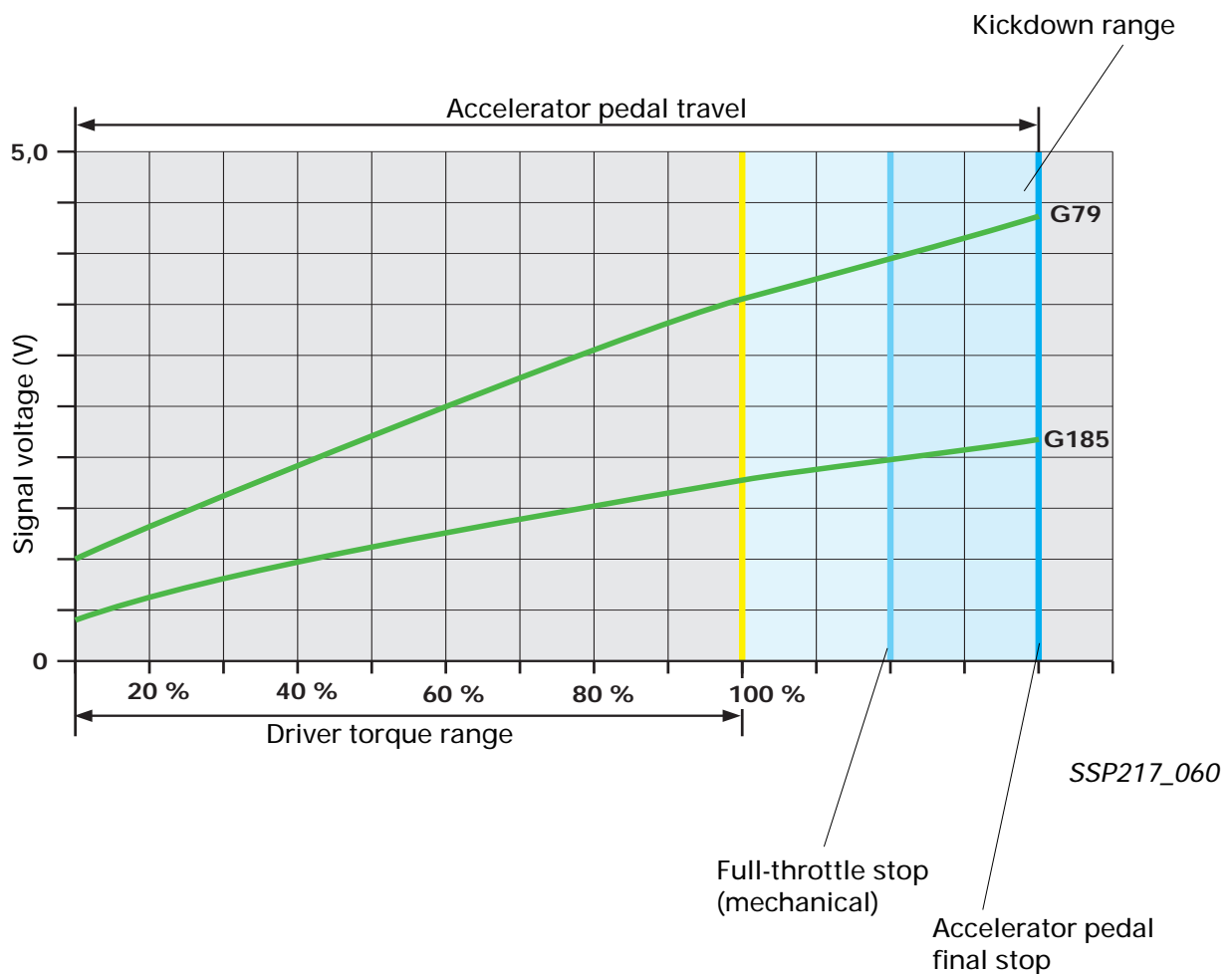
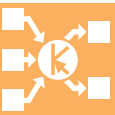


SSP217_041

Accelerator pedal module (Audi A6)

No separate switch is used to provide kick-down information. In the case of automatic-gearbox 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".

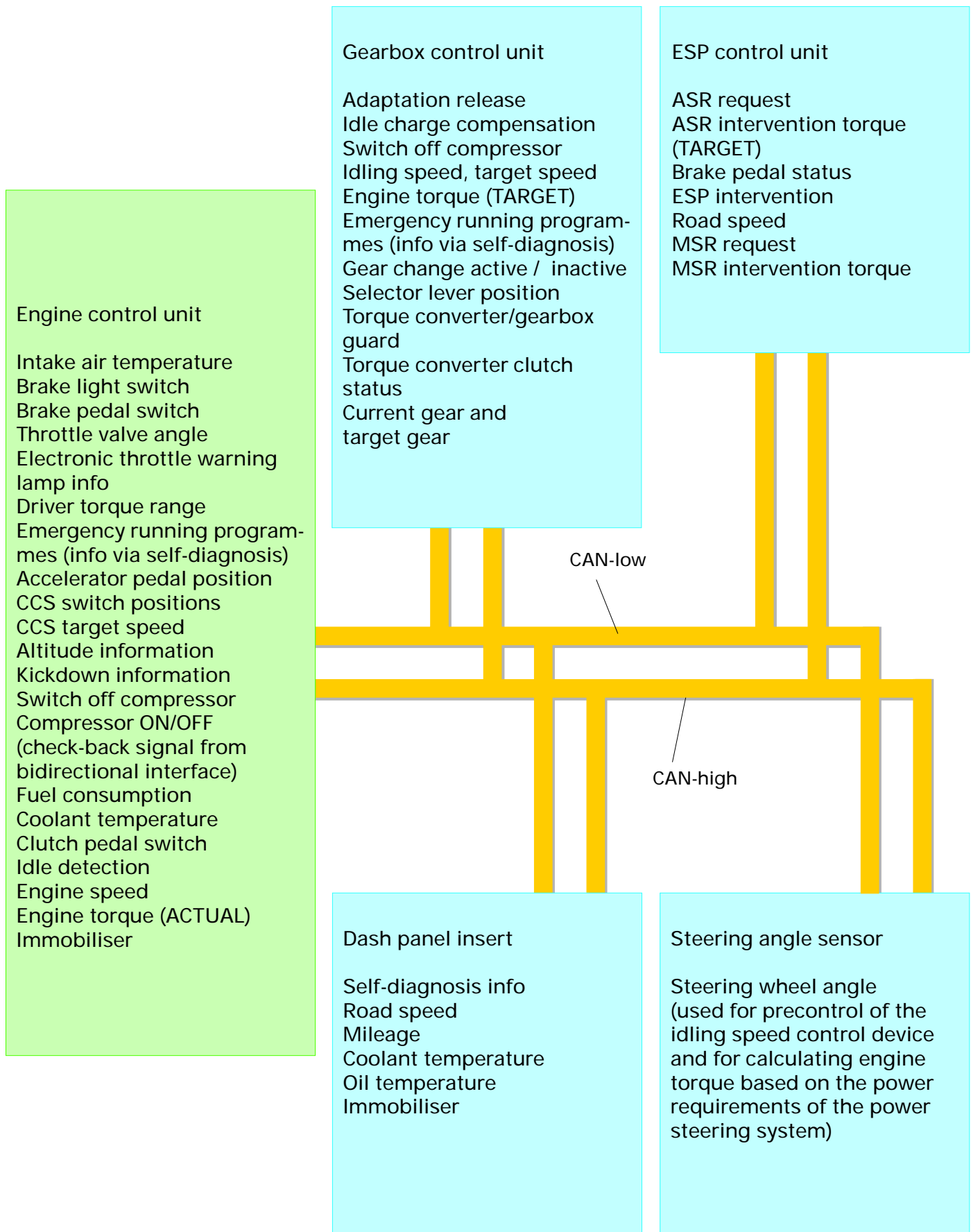
If the driver activates the kickdown, the full-throttle voltage of the accelerator pedal position senders is exceeded. If a voltage defined in the engine control unit is reached, this is interpreted as a kickdown and the information is sent to the automatic gearbox via the CAN bus. The kickdown switching point can only be tested using diagnostic testers.



If the accelerator pedal module or the engine control unit is changed, the switching point of the kickdown switch must be reprogrammed using the diagnostic tester – see the repair manual.

Engine Management

CAN bus interfaces



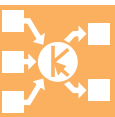
In the Audi A8, data between the engine control unit and the other control units is, with the exception of a few interfaces, exchanged via the CAN system.

The system overview shows the information which is provided by the engine control unit via the CAN bus, and received and used by the connected control units.

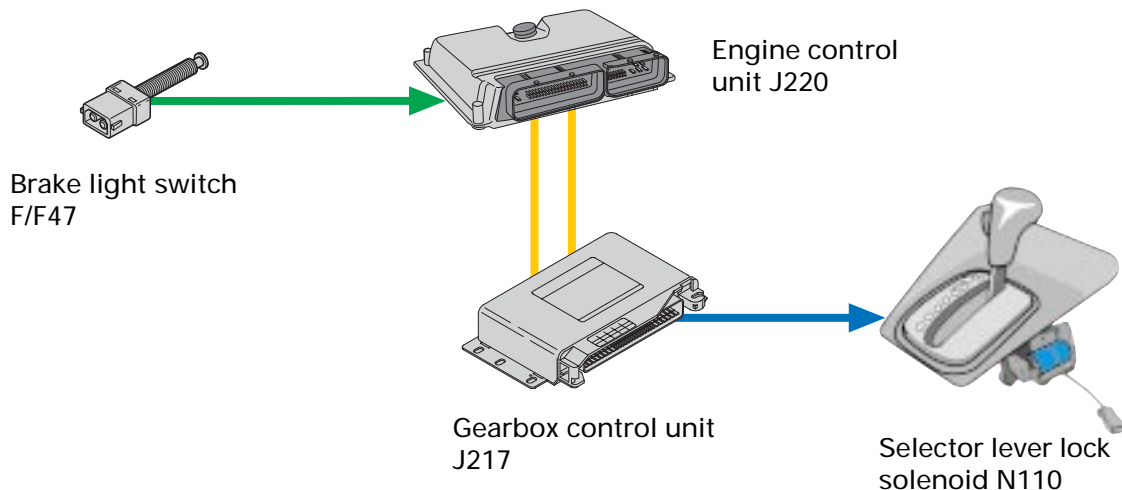
The following two examples simplify the complexity of the CAN bus network.



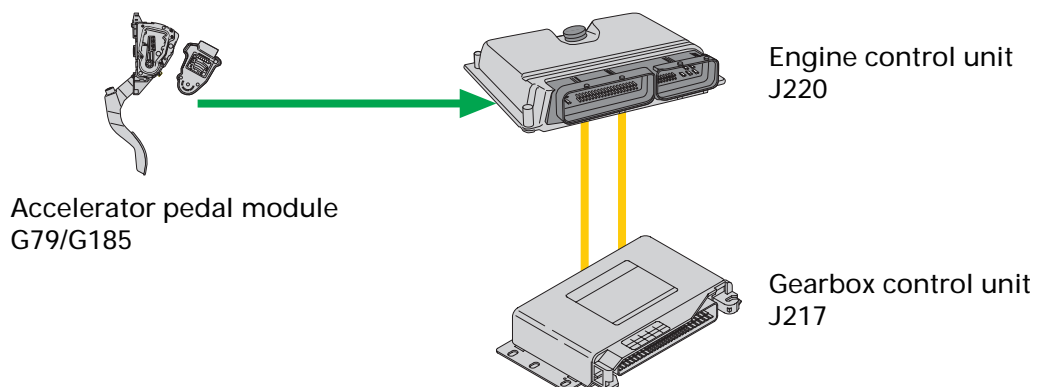
Detailed information concerning the CAN data bus can be found in SSP 186.



Selector lever lock:



Kickdown (for example, Audi A6):



Information which is sent by the engine control unit.

Information which is received and evaluated by the engine control unit.

Engine Management

Additional signals/ interfaces

In the Audi A8, the following interfaces also exist for data exchange via CAN bus:

- Pin 67 Crash signal
- Pin 43 K-line/diagnostic connection
- Pin 41 Compressor ON/OFF
- Pin 40 Air conditioner requirement signal

In the A6, there will be no CAN data exchange with the dash panel insert when production of the model begins. For this reason, the A6 has the following interfaces in addition to those of the A8:

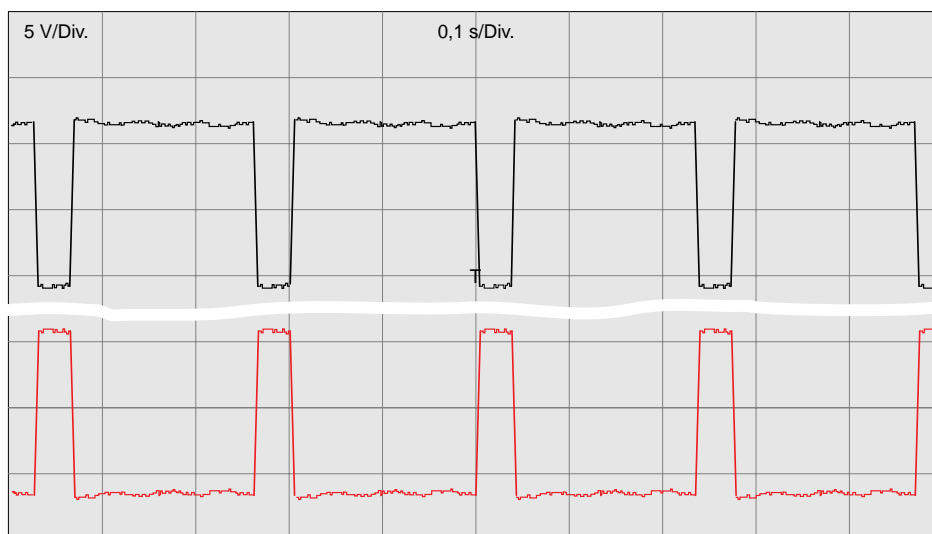
- Pin 43 Immobiliser/self-diagnosis
- Pin 19 Coolant temperature signal
- Pin 81 Fuel consumption signal
- Pin 54 Road speed signal
- Pin 37 Engine speed signal
- Pin 48 Warning lamp for electronic throttle

Most of the interfaces and additional signals of the ME 7.1 are described in SSP 198. Only the new interfaces and additional signals are dealt with below.

Crash signal

Signal traces for crash signal using oscilloscope
function of VAS 5051

Automatic mode



Standard signal
Crash triggering

SSP217_058

In the event of a crash where the belt tensioners/airbags are triggered, the engine control unit deactivates actuation of the fuel pump relay. This prevents excessive quantities of fuel escaping if the fuel system is damaged.

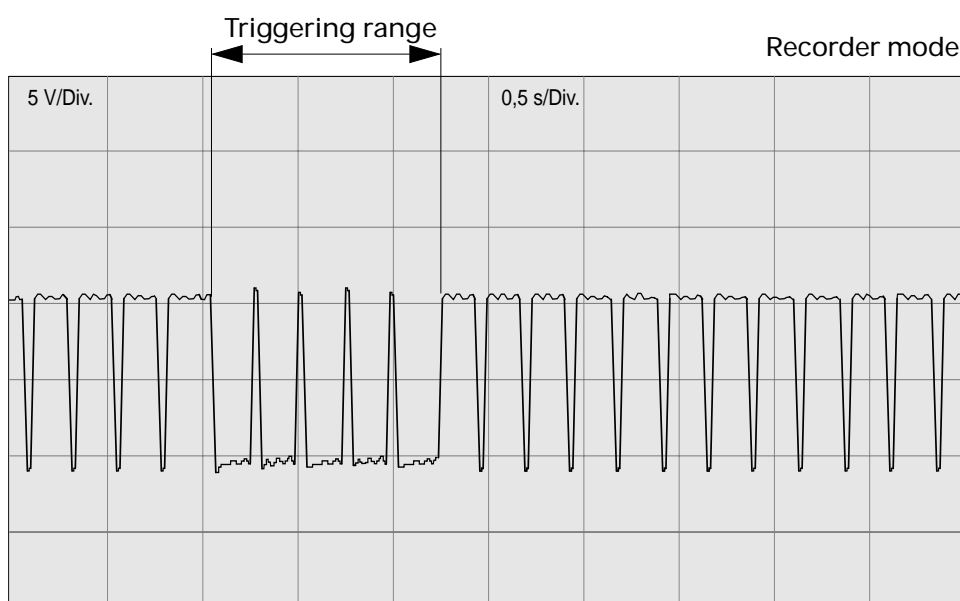
In the event of a crash, the signal ratio is inverted for a defined period of time. During this period, the signal ratio is inverted relative to the standard signal so that the supply of fuel is shut off until the engine is restarted.

The crash signal is a square-wave signal with a specific signal ratio (high level to low level). The signal is transmitted continuously by the airbag control unit.

In addition, the "crash shut-off" fault is stored.



The fault entry can only be deleted using the diagnostic tester.



Crash signal
with triggering

SSP217_059

Engine Management

Self-diagnosis

The crash signal is checked with respect to the plausibility of the crash signal and voltage.

Effect of fault

If the "crash shut-off" fault is stored in the engine control unit and is not erased, the fuel pump is not primed with fuel when the ignition is switched on (no precompression is generated in the fuel system). This may result in delayed starting of the engine.



The fuel shut-off system will not be incorporated in the Audi A6 and A8 until model year 2000.



Further information concerning the fuel shut-off system can be found under Vehicle Safety in SSP 207 and SSP 213.

The air conditioner requirement interface

In the case of a high air conditioner output requirement, the idling speed of the engine is increased to increase the output of cool air from the air conditioner compressor.

In some cases, air conditioning requirements may be such that the "air conditioner requirement" interface is also switched to "high" at the air conditioner operating and display unit whereupon the engine control unit is informed of the increased output requirement.

This can be tested using the "Read measured value block" function of the diagnosis tester (see repair manual).

It is important to note that the function for increasing the idling speed is not available for all engine variants, even if the signal is sent to the engine control unit.

Self-diagnosis

The air conditioner requirement interface is not monitored by the self-diagnosis system.

Effect of fault

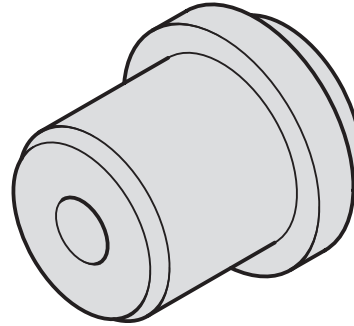
The idling speed is not increased which results in a reduction in the output of cool air when the engine is idling.

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

Thrust pad

for crankshaft oil seal

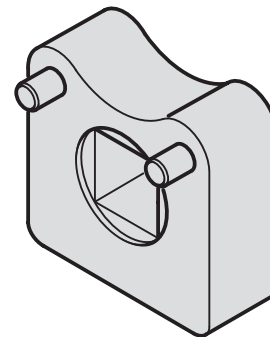
Order No.T40007



SSP213_007

Tensioning roller spanner

Order No.T40009



SSP213_008

Camshaft retainer

Order No.T40005



SSP213_009



	<h1>Notes</h1>	

Dear Reader,

This self-study programme has allowed you to familiarise yourself with the new technical features of the V8-5V engine.

Our aim is to make the content of the self-study programme material as interesting as possible.

This is why we want to give you the opportunity to tell us your opinions and suggestions for future self-study programmes.

The following questionnaire is intended to assist you in doing this.

Send your comments and suggestions to the fax number 0049/841 89 36 36 7.

We thank you for your support.

The Technical Training Service Team

