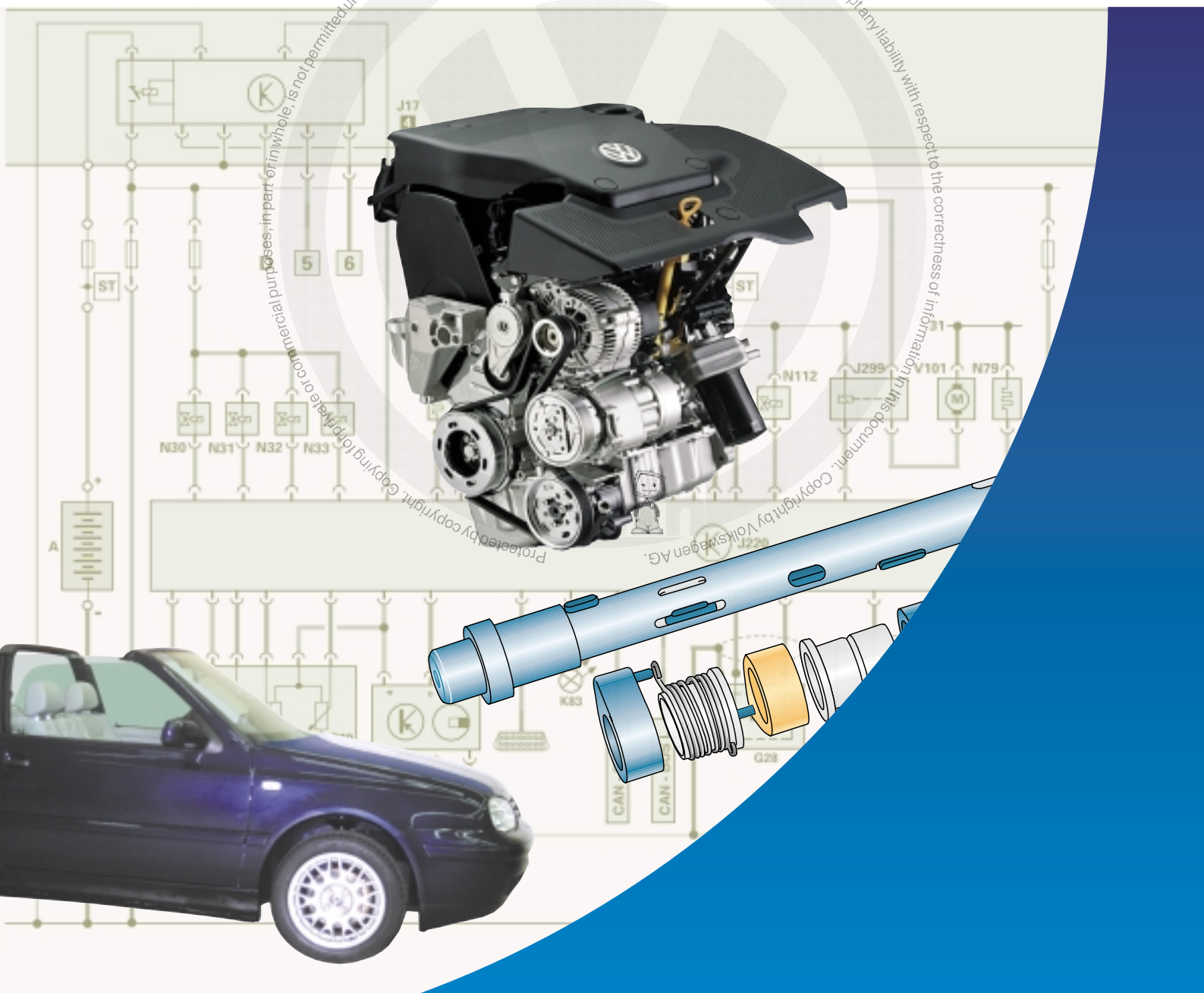
Service.

Self-Study Programme 233

2.0-litre Engine

Design and Function



The 2.0-litre engine stems from a successful engine generation and has a long history.

The engine blocks of the 1.6-litre and 1.8-litre engines have a similar design.

The functions of components such as the coolant pump, radiator, oil pump and oil pump motor are identical.

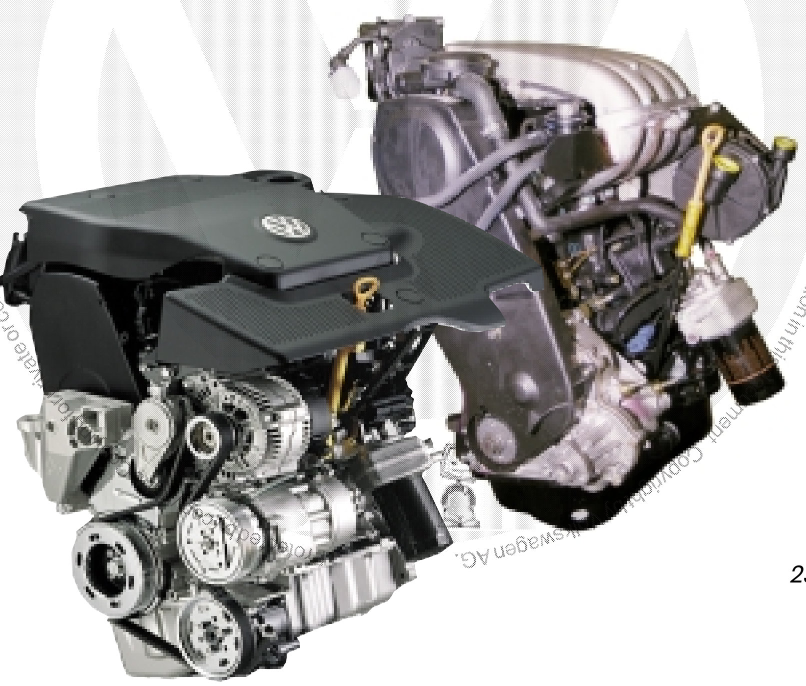
A notable feature of these engines is their closed system control loops which greatly reduce the pollutant emission in the exhaust gases.

The 2.0-litre engine has different structural design details than the 113 and 827 series.

In this Self-Study Programme, you can familiarise yourself with the design and function of the 113 series engine and 827 series engine with intermediate distributor drive shaft.

VW has been fitting the engine with intermediate shaft in the Golf convertible since May 1999.

The 2.0-litre/88 kW engine with flying camshaft (Flino) and new functional features will also be presented.



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New

Important Note

The Self-Study Programme is not a Workshop Manual!

Please always refer to the relevant Service Literature for all inspection, adjustment and repair instructions.
Service Literature.

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2.0-litre/85 kW engine AQY/ATU

Specifications
Differences/common features

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113 series – engine AQY

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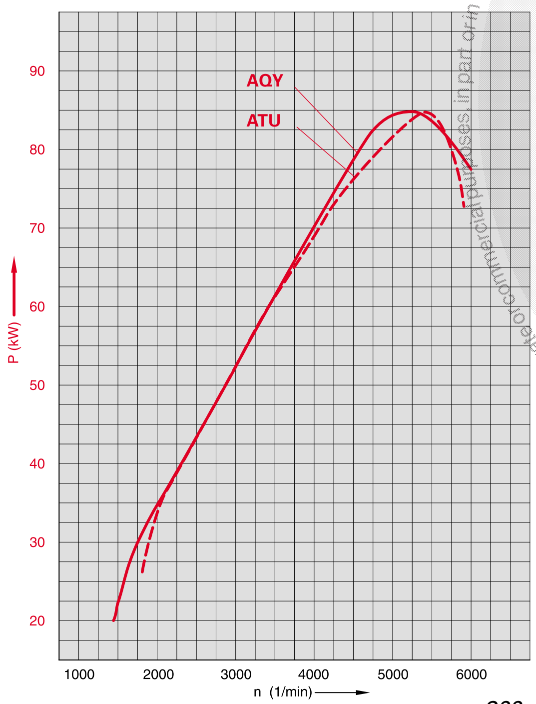
827 series – engine ATU

Series	**113**	**827**
Engine code	**AQY**	**ATU**
Type	4-cylinder in-line engine	
Displacement	1984 cm^3	
Bore	82.5 mm	
Stroke	92.8 mm	
Compression ratio	10.5 : 1	10.0 : 1
Rated power output	85 kW/5200 rpm	85 kW/5400 rpm
Torque	170 Nm/2400 rpm	165 Nm/3200 rpm

Technical features
Differences/common features

	AQY	ATU
Engine management	Motronic 5.9.2	
Lambda control	Probe upstream of catalytic converter Probe downstream of catalytic converter	
Knock control	2 knock sensors	1 knock sensor
Ignition system	Static high-voltage distribution with 2 twin spark ignition coils	Rotating distributor
Self-diagnosis fault warning lamp	in dash panel insert with manual gearbox (EU4) only	not fitted
Exhaust gas treatment	Secondary air system without secondary air injection valve	Secondary air system with secondary air injection valve
Fuel	Premium unleaded (RON 95)	Premium unleaded (RON 95)
Exhaust emission standard	EU 4 Manual gearbox D4 Automatic gearbox	D4 Manual gearbox D3 Automatic gearbox



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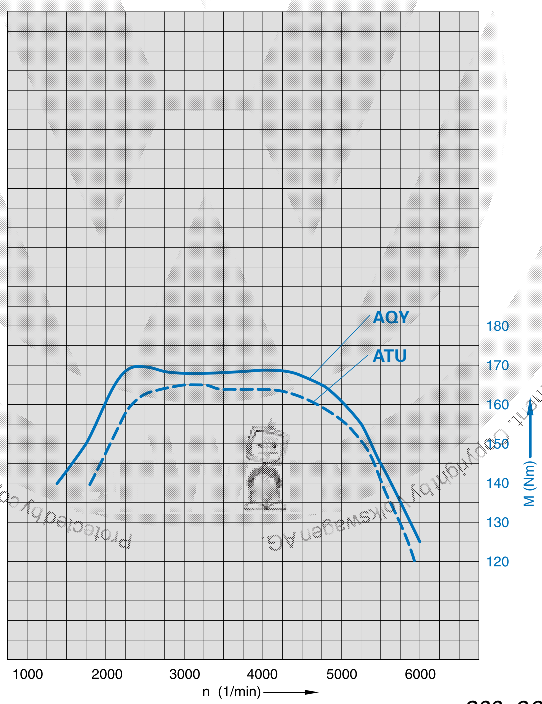
Comparison of performance curves



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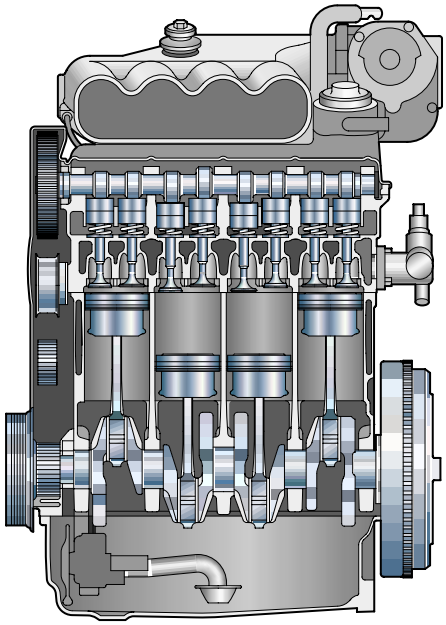
Comparison of torque curves

2.0-litre/85 kW engine AQY/ATU

Engine overview
Differences/common features



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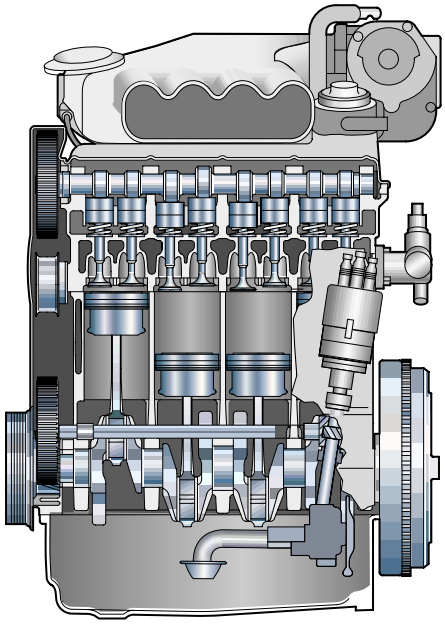
Engine AQY



233_004

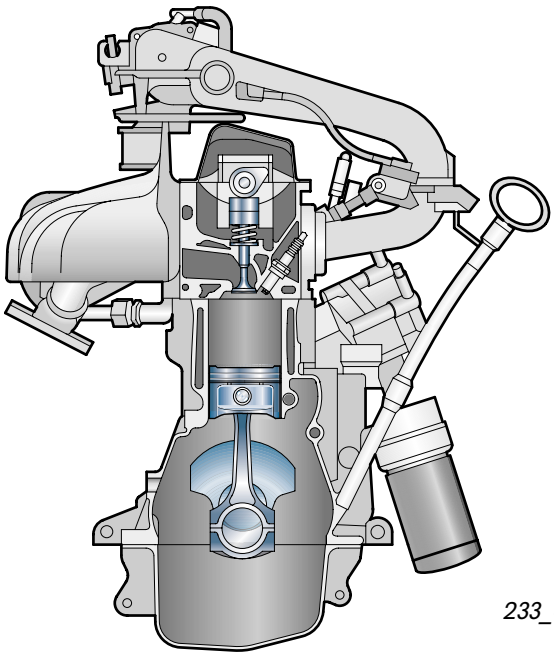
ATU engine

– AQY engine — without distributor, static high-voltage distribution; engine suspension: pendulum support.
– ATU engine — with distributor, drive by means of intermediate shaft; conventional engine suspension

Notable differences

Details of the assemblies used in both engines:

– The crankshaft is mounted on 5 bearings.
– The cylinder block is manufactured from gray cast iron.
– The crankcase is ventilated via the cylinder head cover.
– Lighter pistons reduce moving masses in the engine.
– The cylinder head is made of aluminium.
– The oil sump used in the AQY engine is made of aluminium and has 3 mounting points facing towards the gearbox.
– The oil pump used in the AQY engine is an internal gear pump. It is driven by the crankshaft by means of a chain. The oil pump used in the ATU engine is driven via the intermediate shaft.
– Spray jets for piston cooling: the ATU engine does not have a piston cooling system.
– The reference marks and engine speed are registered by senders mounted on the crankshaft.
– Phase recognition by Hall sender. Mounted on the camshaft in the AQY engine and on the distributor in the ATU engine.



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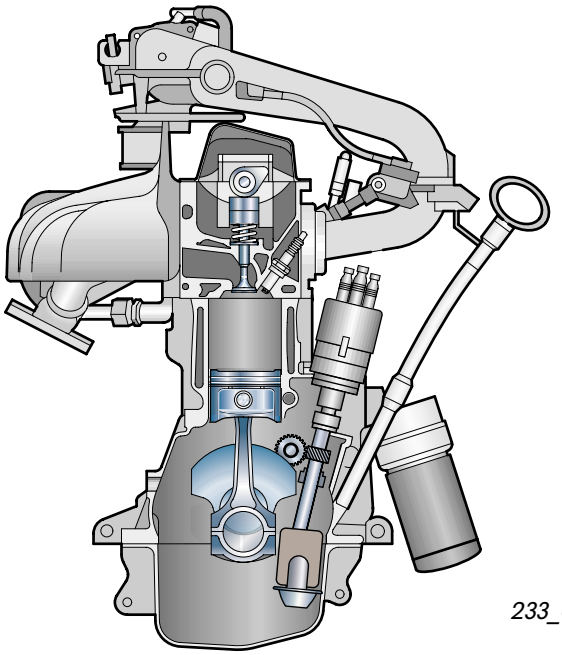
Engine AQY



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Engine ATU

The crossflow cylinder head is based on tried and tested structural design details.

It is also used in the 1.6-litre engine with twin-path intake manifold.

It offers the following advantages:

– optimised intake/exhaust ports for improved handling performance and exhaust emission through a tumble duct

– The intake manifold located at the front end of the engine reduces the crash impact, as there is more space between the intake pipe and the engine bulkhead. The manifold is a two-piece construction.

The stainless steel exhaust manifold is a double-flow manifold. Each cylinder has its own exhaust pipe; these pipes are then paired up.

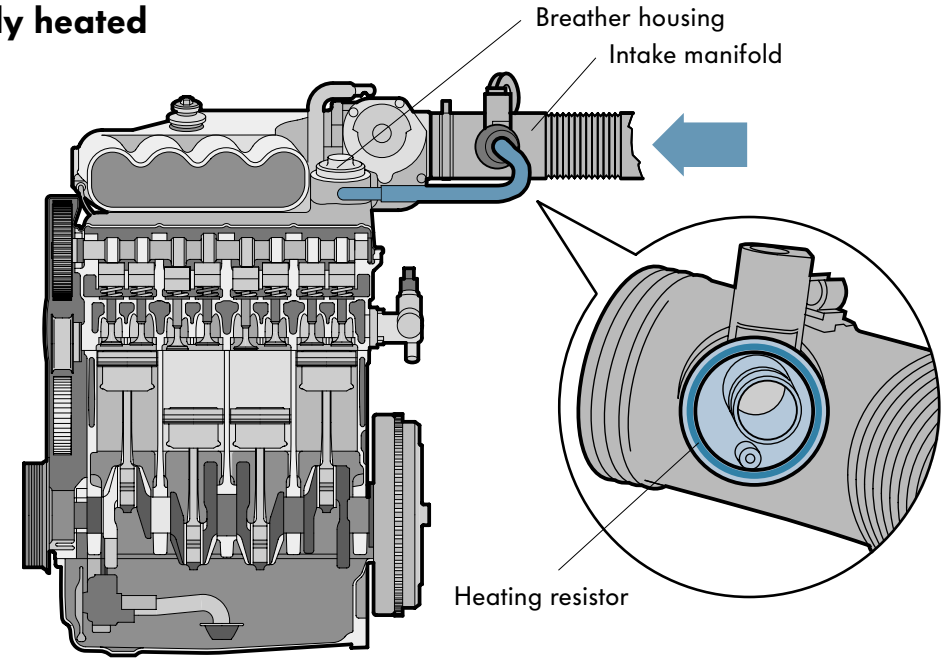
The lightweight valve gear is used:

– 35 mm dia. hydraulic bucket tappet
– 33 mm dia. exhaust valves
– 40 mm dia. intake valves
– 7 mm dia. valve stem

Intake valve lift: 10.6 mm
Exhaust valve lift: 10.6 mm

Crankcase breather

Electrically heated



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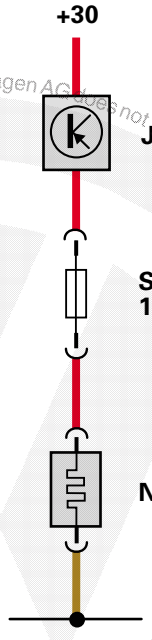
Task

The crankcase is fitted with a breather in order to equalise the pressure difference inside the crankcase.

The crankcase fills up all the way from the oil sump to the cylinder head cover. It fills up not only with oil vapour from the oil sump, but also with gases which escape from the combustion chamber by bypassing the piston rings.

The pumping movement of the pistons returns this mixture of gas and oil vapour to the intake manifold via the breather in the cylinder head cover.

To prevent the vapour from condensing and freezing when they enter the intake manifold during winter operation, there is an annular electrical heating resistor around the inlet.



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Action period

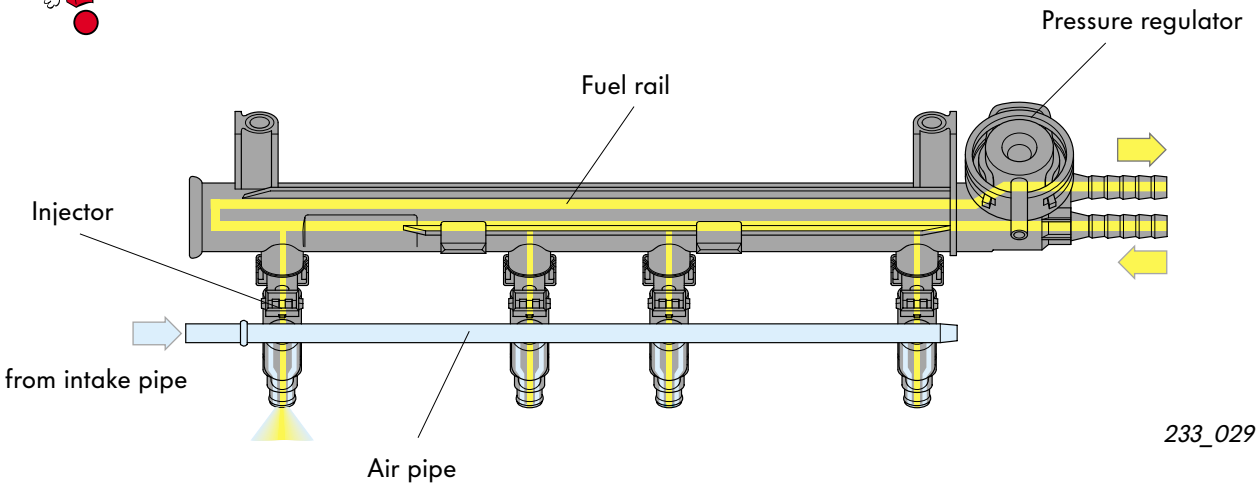
The heating resistor operates continuously when the ignition is "on".

Electrical circuit

J17 Fuel pump relay
N79 Heating resistor (crankcase breather)

Injector with air shroud

The ATU engine has no air-shrouded injectors!



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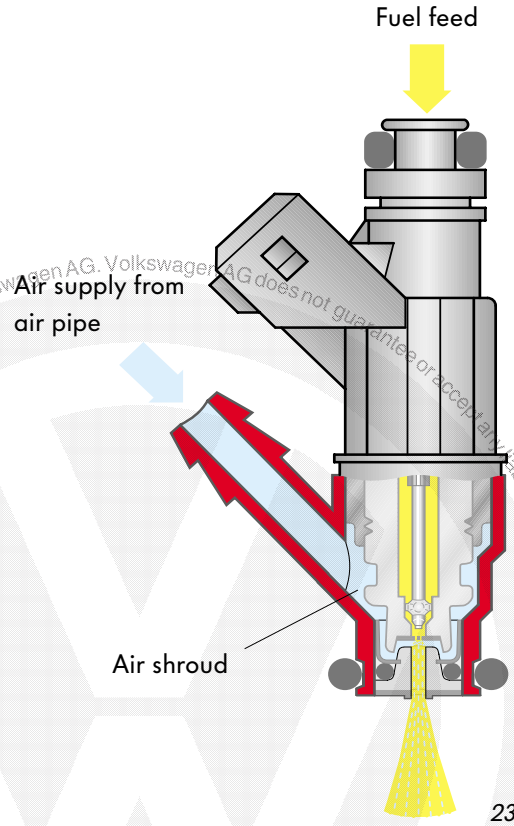
A single injector is assigned to each cylinder.
The four injectors are inserted into the fuel rail at the top and into the engine intake manifold at the bottom.
Fuel flows through these injectors from top to bottom according to the so-called “top-feed” principle.

The injectors have an additional air shroud which improves mixture preparation.
An air pipe is connected to the intake pipe.
Each injector is, in turn, connected to the air pipe.
The vacuum in the intake manifold draws air out of the intake pipe. This air is then fed to each individual injector along the air pipe.
The fuel and air molecules interact in such a way that the fuel is finely atomised.
The air shroud is mainly effective in the part-throttle mode of the engine.



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Advantages:

Combustion is improved.
Pollutant emissions in the exhaust gas are reduced.

Piston

Piston design

Lightweight aluminium pistons are used. They have a shortened, graphitised shaft and the bearings for the piston pins are offset inwards.

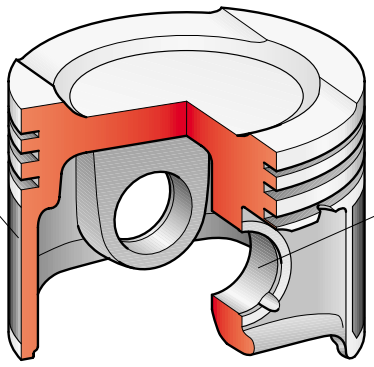
The piston is box shaped.

A shorter - and therefore lighter - piston pin can be used.

There is a recess in the base of the piston.

Over and above the advantages of lighter piston and piston pin construction, the piston has a relatively narrow slip face.

The piston shape necessitates a defined installation position. This position is marked by an arrow on the base of the piston (pointing towards belt pulley).



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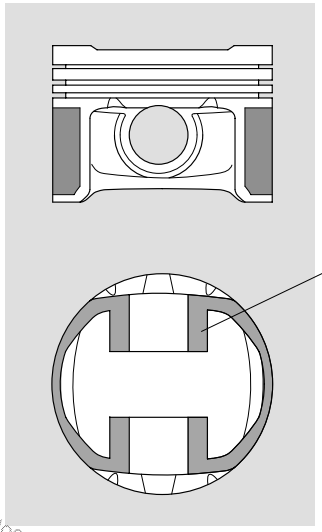

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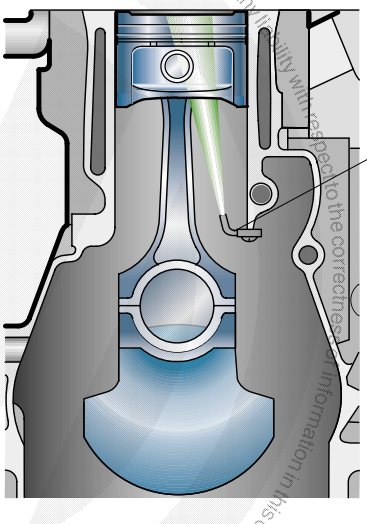
Piston cooling

To cool the piston more rapidly, a small amount of the lubricating oil in the circuit is diverted to the piston.

For this purpose, each cylinder has an oil spray nozzle which is securely bolted to the cylinder block and supplied with oil directly from the oil pump via an oil duct.

The oil spray nozzle has a pressure relief valve which opens at a pressure of 0.25 to 0.32 MPa.

The lubricating oil is fed into the interior of the piston and cools the piston down.



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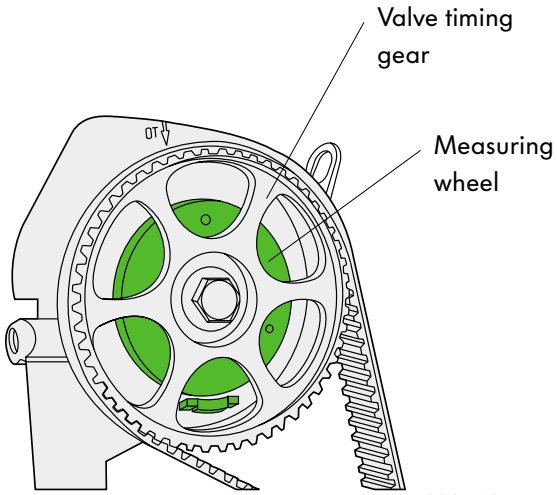
The ATU engine has no oil spray nozzle for piston cooling.

Hall sender G40

The Hall sender is located behind the valve timing gear.
The measuring wheel is secured to the back of the valve timing gear.



233_034

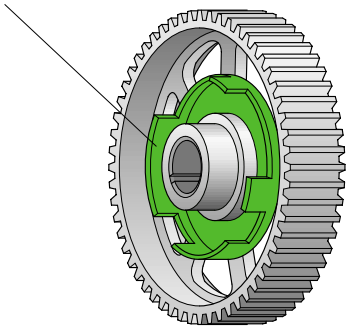
Signal utilisation

The position of the camshaft is determined via the signal from the Hall sender.
The Hall sender also acts as a quick-start sender.

Function and design

Two measuring windows on the measuring wheel are wide and two measurement windows are narrow. A characteristic signal pattern is generated for each 90° crankshaft rotation.
In this way, the engine control unit can determine the position of the camshaft and control the fuel injection and ignition sequences before the engine has completed half a revolution (quick-start sender).
Cold-starting is improved.
There is less exhaust emission during the cold start process.

Measuring wheel with measurement window



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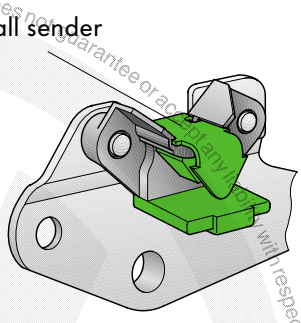
Substitute function and self-diagnosis

If the Hall sender fails, the engine continues to run and utilises a substitute signal for this purpose. The ignition advance angle is retarded as a safety precaution.
The sensor is tested during the self-diagnosis procedure.

Important
The ATU engine has a rotating ignition distributor which is driven by means of the intermediate shaft.

The Hall sender and rotor ring are located in the distributor.



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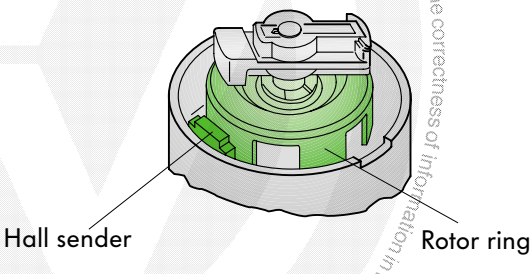


233_006

PTFE oil seal

The crankshaft and camshaft oil seals are radial oil seals made of PTFE (**P**oly**t**etra**f**luoroethylene).

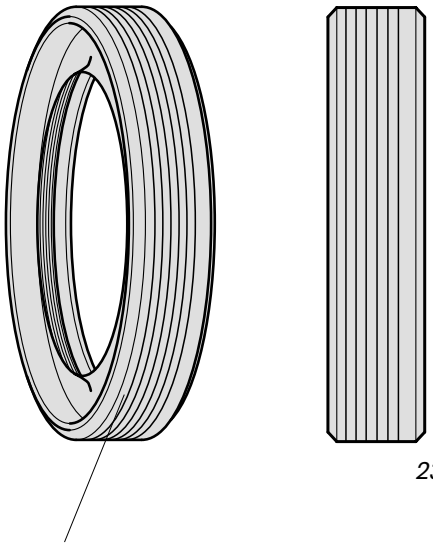
PTFE is also known under the name Teflon and is a type of heat resistant and non-wearing plastic.

These oil seals provide improved sealing from the inside and protect the engine against abrasion and dust from the exterior.

The sealing lip has a hydrodynamic recirculation feature.

Outer diameter ribs allow the oil seal to be fitted more securely in the crankcase.

The design and material require new auxiliary tools to reliably install this new seal generation, as well as different fitting characteristics.



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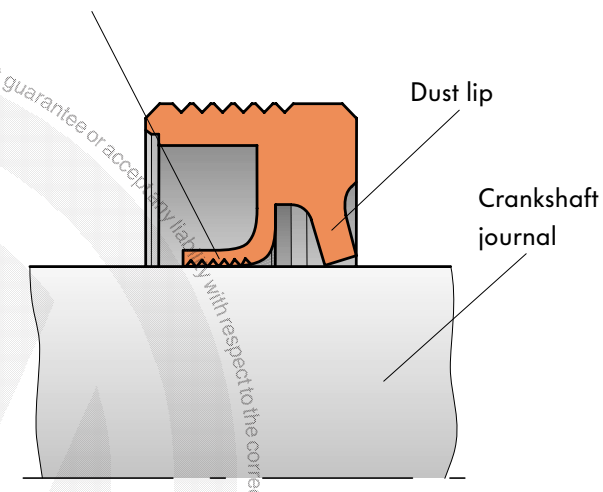
PTFE oil seals are dry fitted.
The sealing plugs of the crankshaft/camshaft must be grease free.
PTFE oil seals are always fitted in fixed directions (right and left rings).



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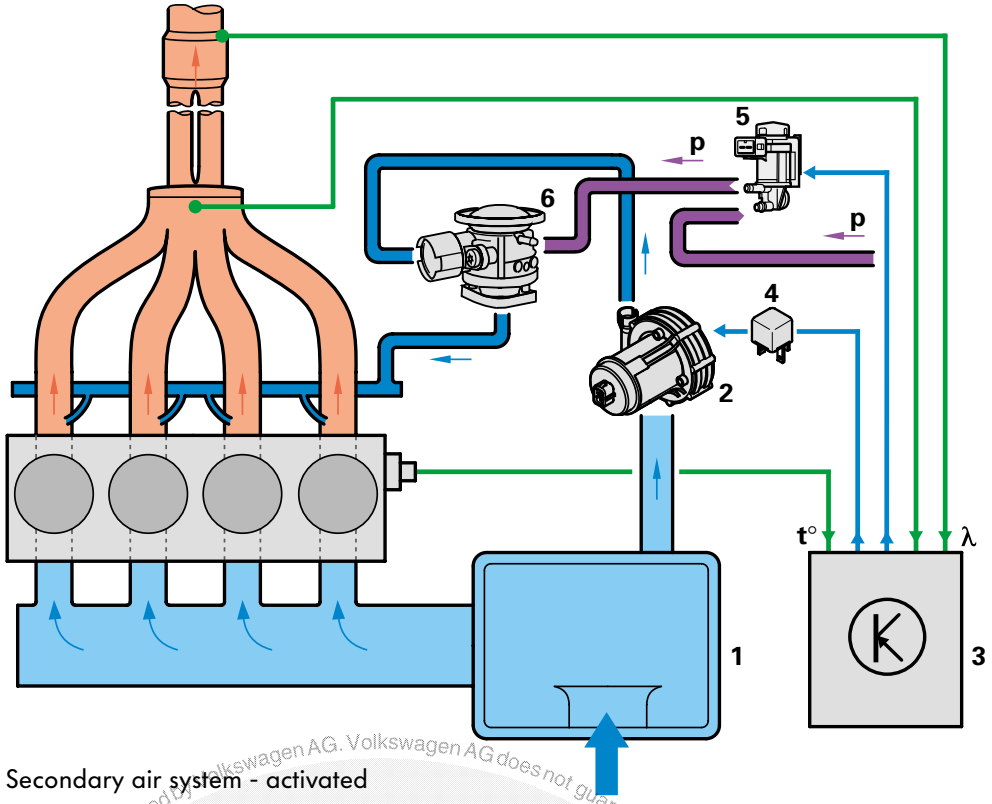
Please also refer to the detailed installation instructions given in the Workshop Manual for the 2.0-litre/85 kW Engine, Mechanicals.

Secondary air system

The secondary air systems used in both engines are not identical. The secondary air control valve can only be found in ATU engine.

In the AQY engine, the combination valve is opened directly by the pressure exerted by the secondary air pump and closed off from the engine by a spring.



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Secondary air system - activated

Starting situation

During the cold starting phase of an engine, the pollutant emissions (non-combusted hydrocarbons) are relatively high on account of the fact that the catalytic converter has not yet reached its operating temperature.

The secondary air system helps to reduce the pollutant emission during this phase.
The exhaust gas is enriched with oxygen through the injection of additional (secondary) air. The non-combusted exhaust gas constituents (carbon monoxide (CO) and hydrocarbons (HC)) are now thermally combusted.
Secondly, the catalytic converter reaches its operating temperature more quickly through the heat generated by secondary combustion.

System design

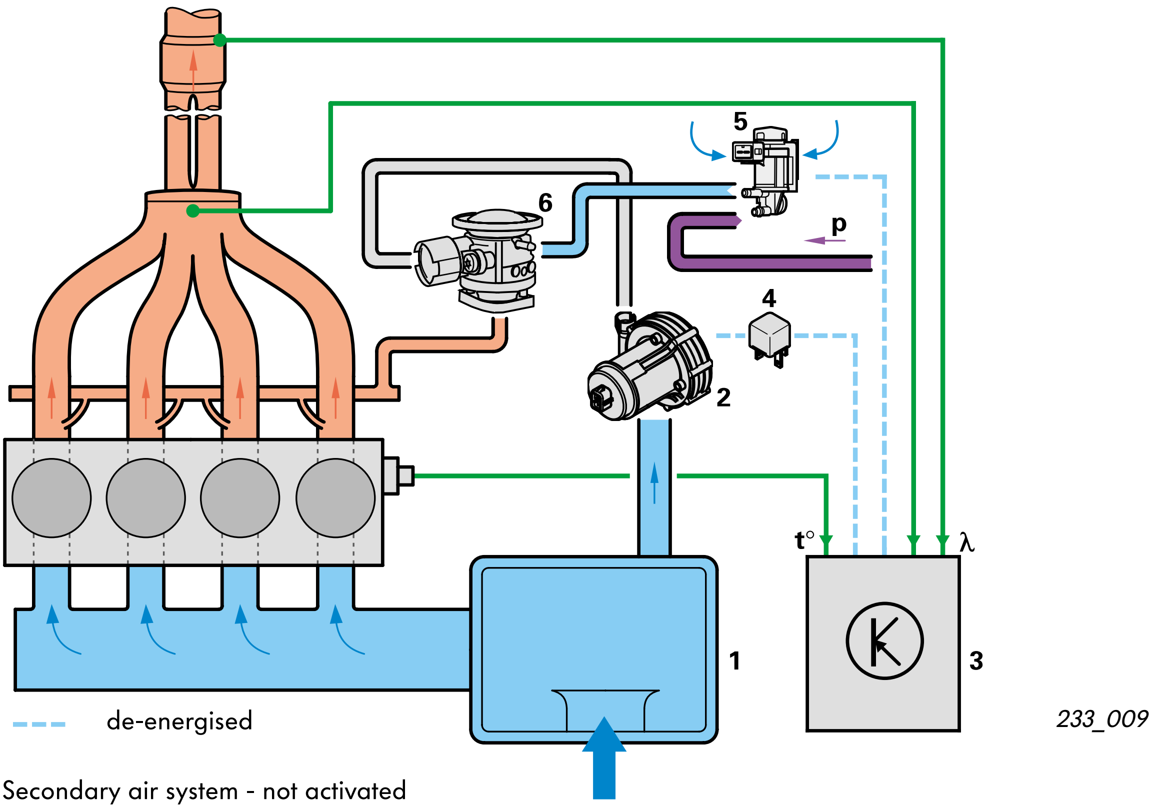
The secondary air pump -2- blows additional air from the air filter -1- directly behind the exhaust valves when the engine is started.

The system works on the basis of interaction between the following system components:

- Engine control unit -3-
- Secondary air pump relay -4-
- Secondary air pump -2-
- Secondary air control valve -5-
- Combination valve -6-

Input variables for the engine control unit are the coolant temperature -t°- and the lambda control -λ-.

Secondary air system



Secondary air system - not activated

Functional description

The secondary air system is active in two operating states and for a limited period of time only:

- cold start
- in idling mode after warm start, for self-diagnosis

The secondary air system is activated by the engine control unit according to the prevailing operating conditions.

State	Coolant temperature	Period activated
Cold start	+5 to 33°C	100s
Warm start Idling	up to max. 96˚C	10s

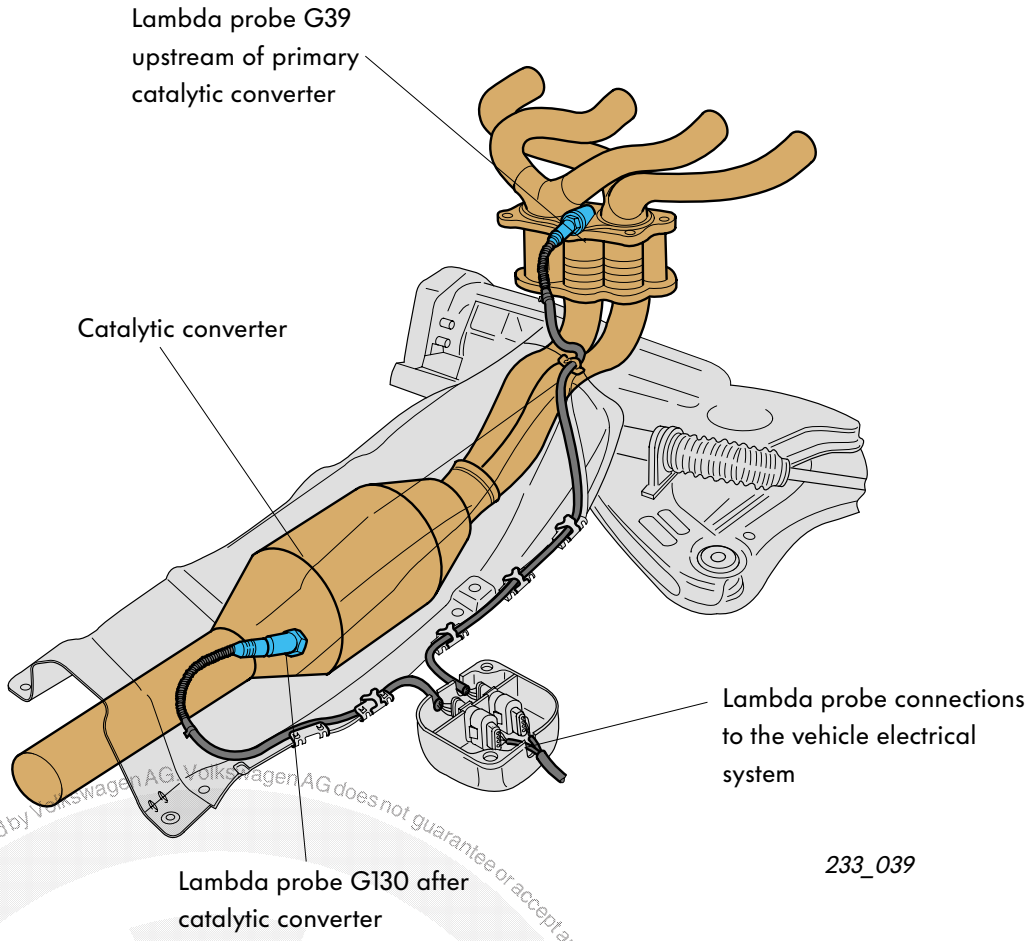
The secondary air pump receives its voltage via the secondary air pump relay. The engine control unit also activates the secondary air inlet valve via which the combination valve is actuated by means of partial pressure "p“.
The secondary air pump injects air downstream of the exhaust valves into the exhaust gas stream for a short period of time.

When the secondary air pump is inactive, the hot exhaust gases are also present at the combination valve. The combination valve seals the exhaust gases off from the secondary air pump.

During the activation procedure, the self-diagnosis checks the system.
The lambda control must be active during the self-diagnosis procedure because the increased oxygen content in the exhaust gas reduces the probe voltage.

When the secondary air system is intact, the lambda probes must register an extremely lean mixture.

Why is a second lambda probe necessary?



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The position of the lambda probes in the exhaust system is very important for emission control as they are subjected to heavy soiling in the exhaust gas.

A probe located downstream of the catalytic converter is less prone to soiling.

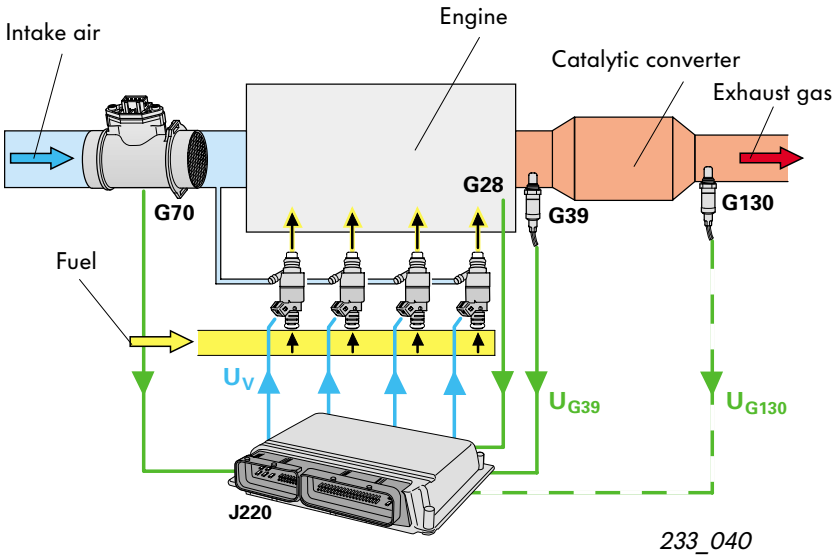
A lambda control system with only one probe downstream of the catalytic converter would be too slow because of the longer gas flow times.

However, the more stringent exhaust emission regulations require quick and precise lambda control.

A second lambda probe (with heating) therefore was installed in the exhaust system downstream of the catalytic converter (G130) in addition to the probe upstream of the catalytic converter (G39).
This probe serves to check for proper functioning of the catalytic converter. The probe upstream of catalytic converter (G39) is also adapted.

Emission control

G28	Engine speed sender
G39	Lambda probe upstream of catalytic converter
G70	Air-mass flow meter
G130	Lambda probe downstream of catalytic converter
U_{G39}	Probe voltage, lambda probe upstream of catalytic converter
U_{G130}	Probe voltage, lambda probe downstream of catalytic converter
U_V	Control voltage, injectors



The signals for air mass and engine speed are the basis for the injection signal (Uv).

The engine control unit calculates the additional injection time correction factor (increase/decrease) for lambda control from the signal supplied by the lambda probe.

The lambda factor is regulated on the basis of continuous data interchange.

The lambda map is still stored in the control unit memory. This map specifies the various engine operating states.

Using a second closed control loop, the shift in the voltage curve corrected within a defined window (adaption) ensuring long-term stability of the mixture composition. The probe downstream of the catalytic converter has priority over the probe upstream of catalytic converter.

The 2nd probe simultaneously checks the degree of conversion (a measure of cleaning efficiency) of the catalytic converter.

The engine control unit compares the probe voltage U_{G39}/probe upstream of the catalytic converter and U_{G130}/probe downstream of the catalytic converter.

If the ratio deviates from the setpoint, this is registered as a catalytic converter malfunction and stored as a fault.

The voltage curves of both probes can be checked in the self-diagnosis.

Effects of malfunction

If the probe upstream of catalytic converter fails, lambda control is not performed. The adaption function is disabled.
Emergency operation via a map-based open control loop.
If the probe downstream of the catalytic converter fails, lambda control is still performed. The function of the catalytic converter cannot be checked.

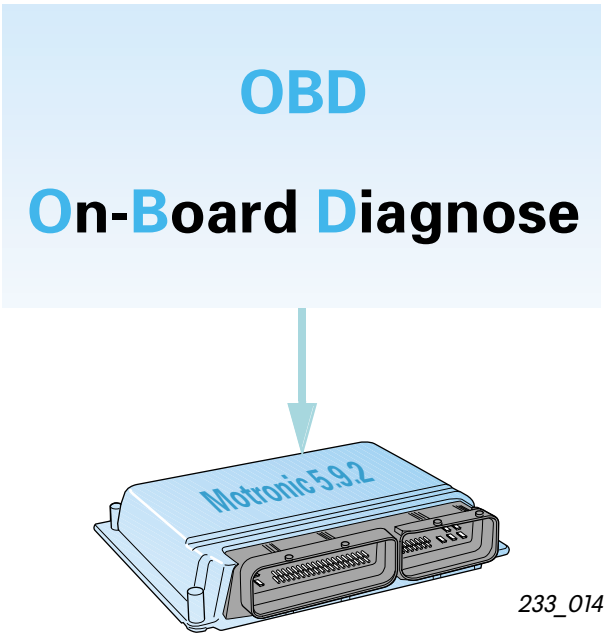
ODB II exhaust emission monitoring system

Malfunctions and defective components in the engine management system can lead to a dramatic increase in pollutant emissions.

The OBD was introduced in order to avoid this. The OBD is a diagnostic system which is integrated in the vehicle's engine management system and continuously monitors the exhaust emission levels.

The Motronic 5.9.2 of both 2.0-litre engines meets these requirements.

The driver is informed about non-conforming exhaust emission levels by a warning lamp (exhaust gas warning lamp K83) only in vehicles with the AQY engine in combination with a manual gearbox.



233_014

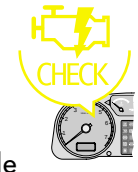
Electrical circuit

The warning lamp is integrated in the dash panel insert, directly connected to the engine control unit and registered by the fault memory.

Like all warning lamps, the exhaust gas warning lamp lights up for several seconds when the ignition is turned on.

If it does not go out after starting the engine or lights up or flashes while travelling, there is a fault in the engine electronics or certain exhaust emissions are too high.

For the customer, this is a sign to take the vehicle to a service workshop.



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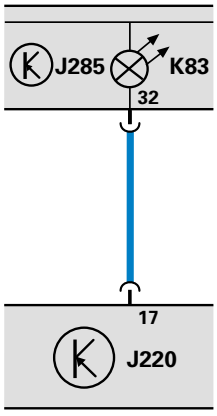
– Lamp flashing:
There is a fault which can damage the catalytic converter in this vehicle operating state. The vehicle may still be operated, but only using less power.

– Lamp lit continuously:
There is a fault which adversely affects emission levels.



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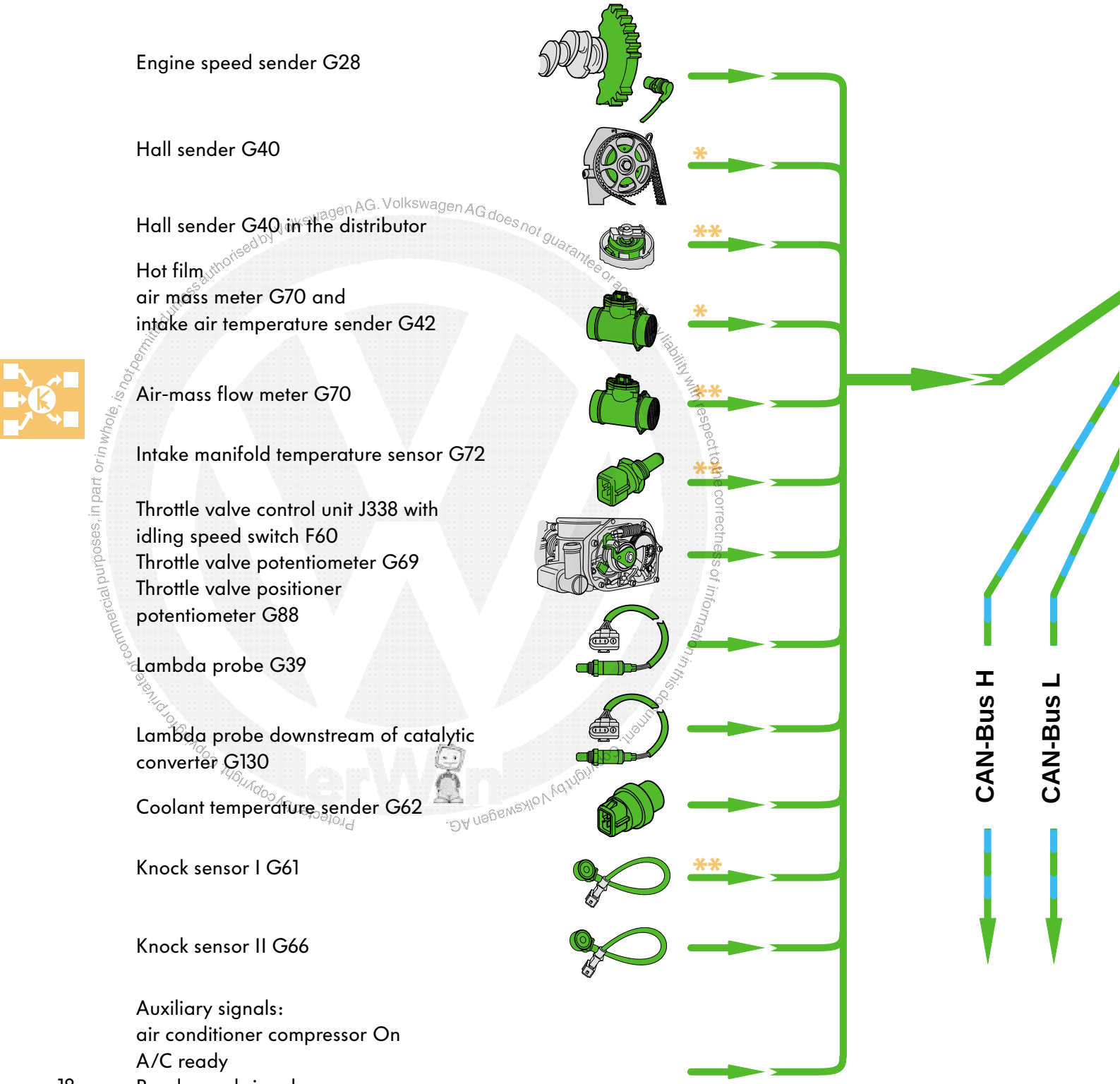
See also SSP 175.

System overview

Motronic 5.9.2

The new Motronic 5.9.2 implements technical improvements for starting of the engine, lower fuel consumption and exhaust emission control.

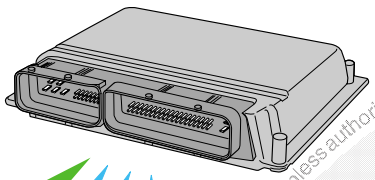
It meets the requirements of OBD II. Pollutant emissions are checked continuously. Diagnoses relevant to exhaust emissions are displayed using the readiness code.

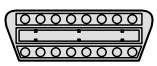


In the Motronic 5.9.2 systems used the both engines, several components are different.
Differences:
* AQY only
** ATU only

See also table with heading
"Differences and Common Features“

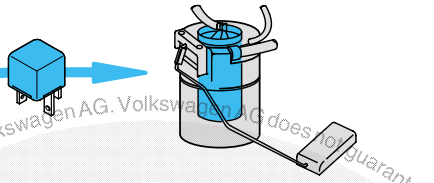
Control unit
for Motronic J220



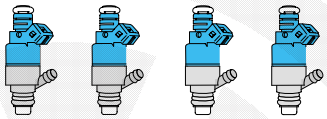


Diagnostic connection

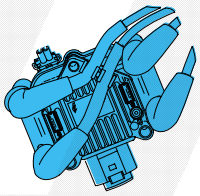
Self-diagnosis fault warning lamp K83



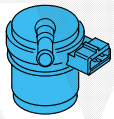
Fuel pump relay J17
Fuel pump G6



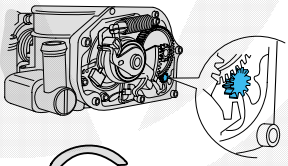
Injectors N30 to N33



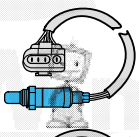
Ignition transformer N152



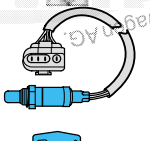
Activated charcoal filter system solenoid valve 1 N80



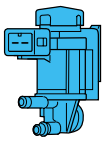
Throttle valve control unit J338
with throttle valve positioner V60



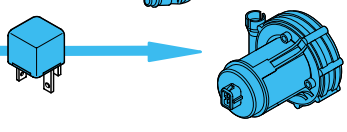
Lambda probe heating Z19



Lambda probe 1 heating,
after catalytic converter Z29



Secondary air inlet valve N112



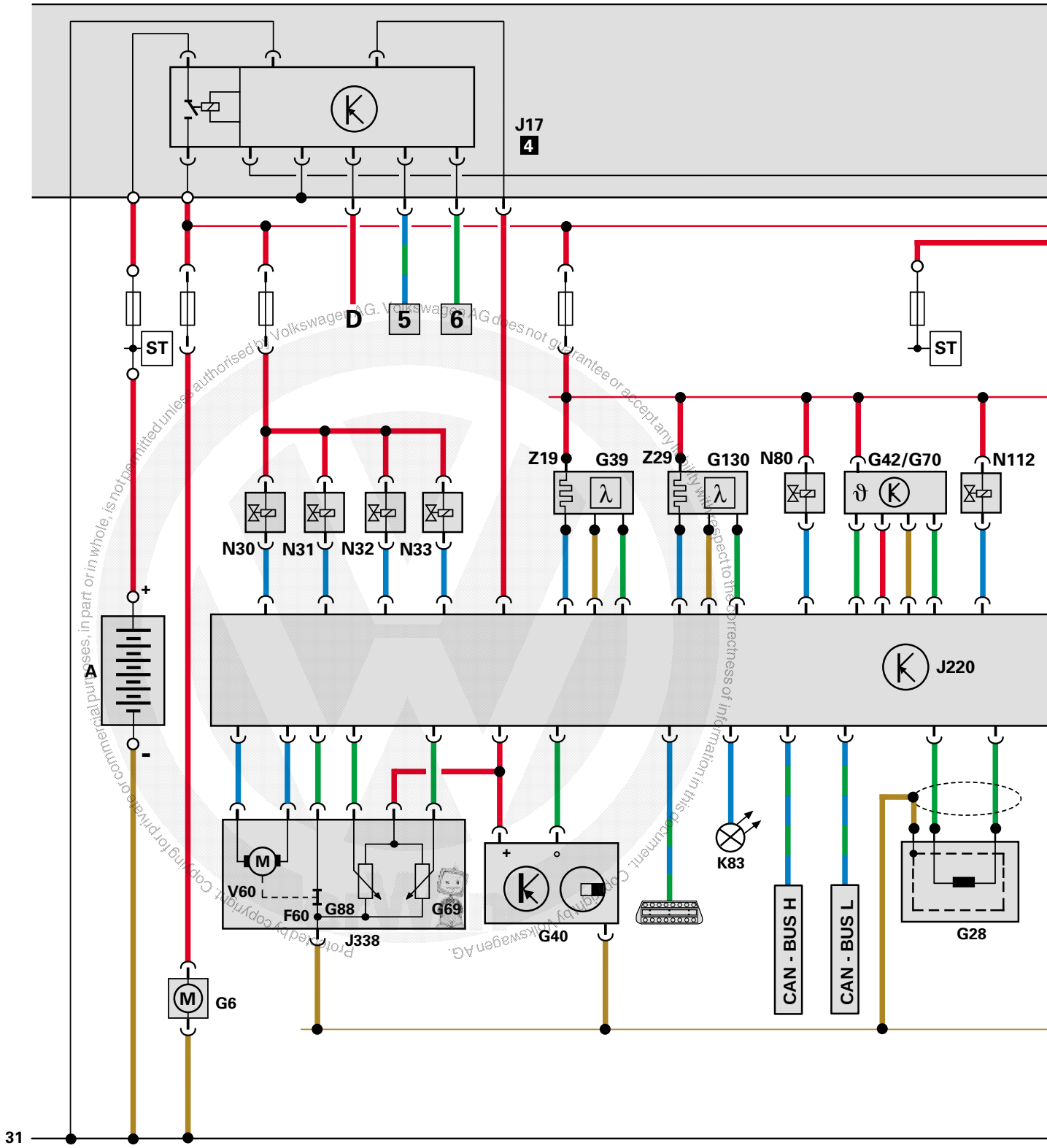
Secondary air pump relay J299
and
secondary air pump motor V101

Auxiliary signals:
Air conditioner compressor Off
Fuel consumption signal

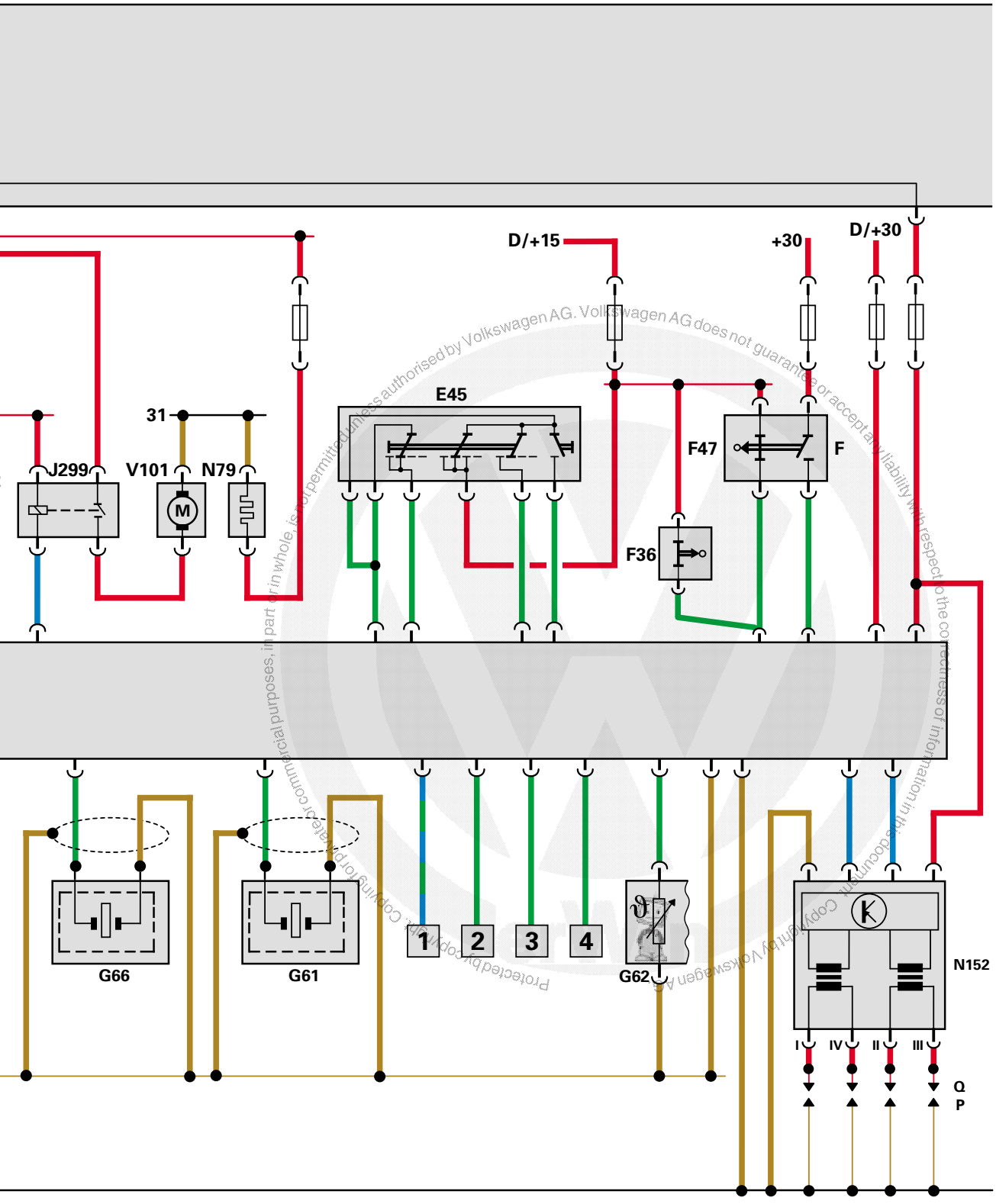
233_010

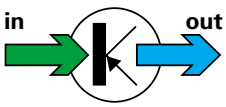
Function diagram

Engine AQY



Please refer to Page 33 for a legend of the function diagram.

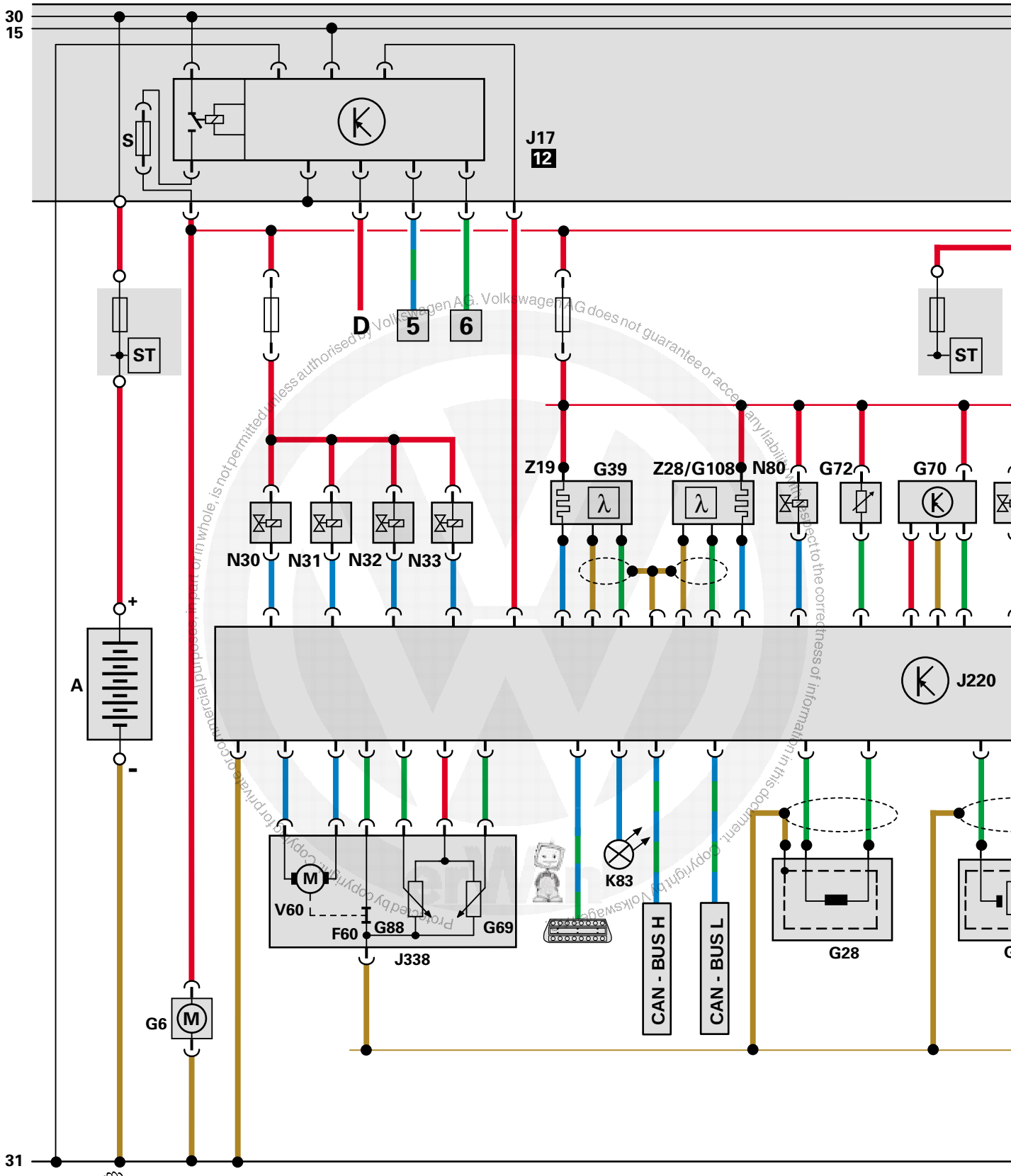




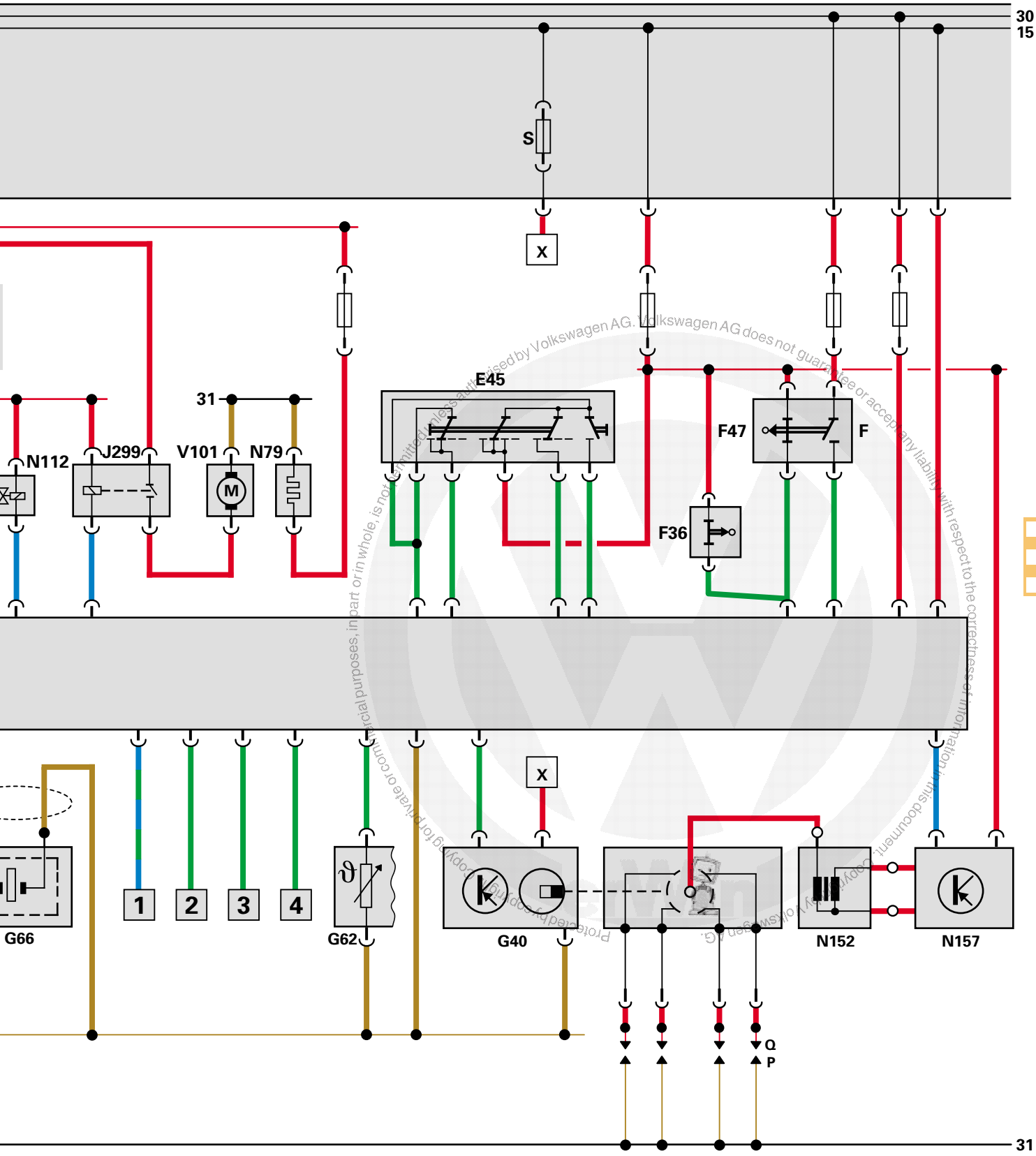
233_011

Function diagram

Engine ATU



Please refer to Page 33 for a legend of the function diagram.



233_015

in out

Self-diagnosis

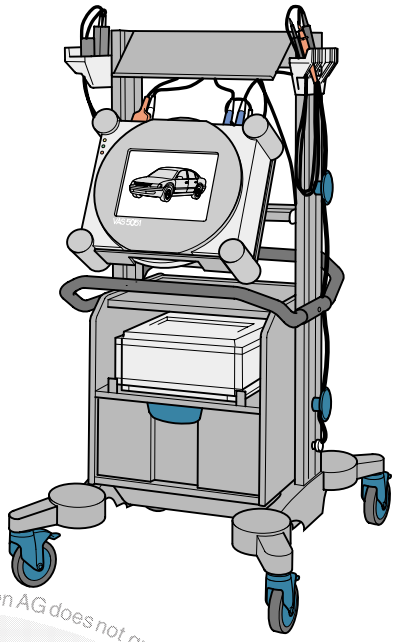
The readiness code

The readiness code is an 8-digit numeric code which indicates the status of the exhaust emission diagnoses. The diagnoses are performed at regular intervals during normal vehicle operation.

The readiness code does **not** indicate whether there are any faults in the system.
It indicates whether certain diagnosis have been terminated -0- or have not been performed yet, or have been cancelled -1-.

If the engine management system has registered a fault and stored this fault in the fault memory, the fault message can only be obtained with a fault reader.

The readiness code can be read out using the Vehicle Diagnostic, Testing and Information System VAS 5051 or the V.A.G Diagnostic Unit using function “15” which can be accessed via address word “01”. The readiness code can also be generated by performing a short test.



202_002

Readiness code

The readiness code for both engines is identical.

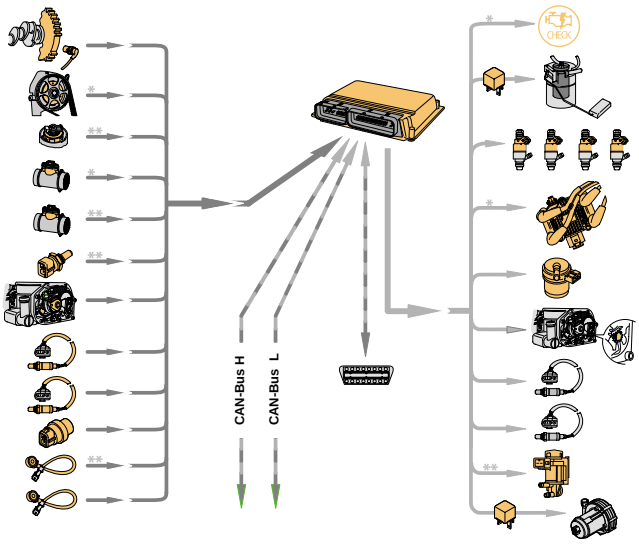
Relevance of the 8-digit numeric block to the readiness code								
The readiness code is only generated when all the digit positions on the display are 0.								
1	2	3	4	5	6	7	8	Diagnostic function
							0	Catalytic converter
						0		Catalytic converter heating (diagnosis function currently inactive/always “0”)
					0			Activated charcoal canister system (fuel tank purging system)
				0				Secondary air system
			0					Air conditioning system (diagnosis function currently inactive/always “0”)
		0						Lambda probe
	0							Lambda probe heater (diagnosis function currently inactive/always “0”)
0								Exhaust gas recirculation (not existent/always “0”)

The Motronic 5.9.2 control unit has a fault memory.

The self-diagnosis function monitors all the colour-coded parts of the system.

The self-diagnosis procedure can be performed using the Vehicle Diagnostic, Testing and Information System VAS 5051 or the V.A.G Diagnostic Unit.

The self-diagnosis procedure is initiated with the address word
01 - Engine electronics.

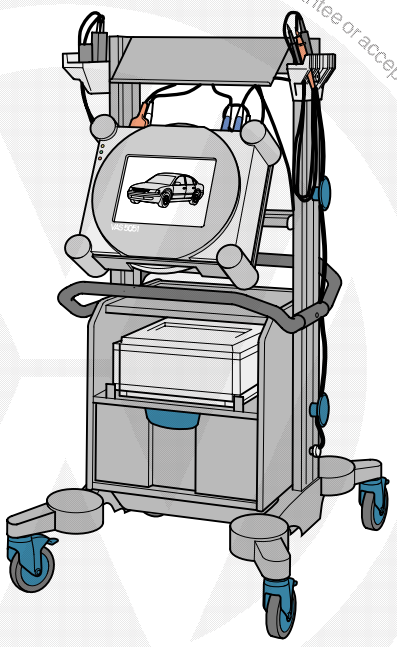


233_018

The following functions are possible:

01 - Interrogate control unit version
02 - Interrogate fault memory
03 - Actuator diagnosis
04 - Basic adjustment
05 - Erase fault memory
06 - End of output
07 - Encode control unit
08 - Read data block
10 - Adaption
11 - Login procedure
15 - Read out readiness code

Function 04 - Basic adjustment must be executed after changing the engine control unit, the throttle valve control part or the engine and after disconnecting the battery.
Advise your customers to visit a workshop to have basic adjustment performed after replacing the battery themselves or after disconnecting and connecting the battery.



202_002

For the various individual fault codes, please refer to the Workshop Manual for Motronic Injection and Ignition System (2.0-litre engine).

2.0-litre/88 kW engine ATF/ASU

The 2.0-litre/88 kW Flino engine is described below. Flino stands for "flying camshaft". The engine will be used in A-platform vehicles, in which it will be mounted transversely, and in the Passat, in which it will be mounted longitudinally.

The improved version of the 2.0-litre engine includes the following characteristic modifications:

- Adjustment of the intake cam
- The system components for service interval extension (new engine oil, engine oil level sensor and engine oil temperature sensor)
- Twin-path intake manifold
- Electric throttle drive

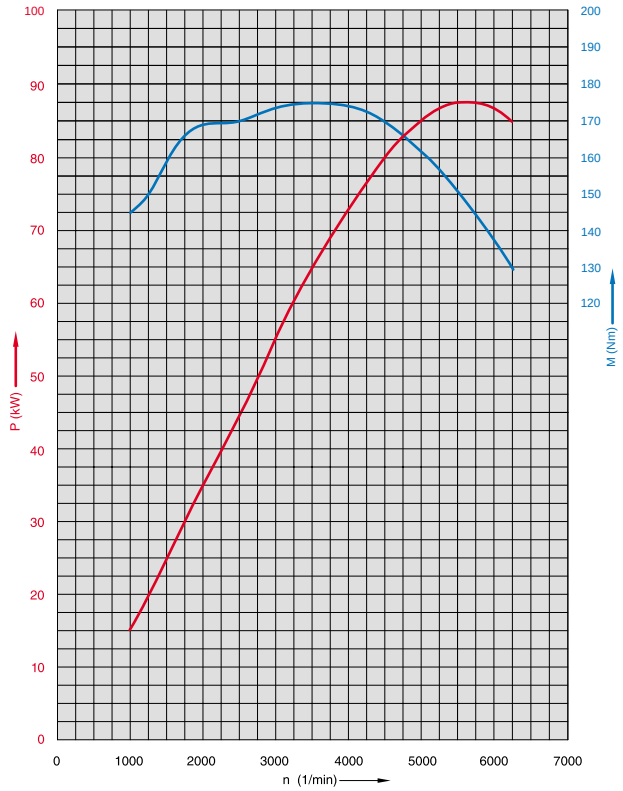
The engine-specific requirements relating to service interval extension and camshaft timing control are described.

Will not be introduced

233_012

Technical features

- Engine management system
  Transversely mounted engine: Bosch Motronic ME 7.5
  Longitudinally mounted engine: Simos 3.2
- Electronically controlled sequential injection and mapped ignition with cylinder-selective knock control
- 2 valves per cylinder
- 2 lambda probes; Syncro: 4 lambda probes
- Secondary air system
- Air-shrouded injectors
- Twin-path intake manifold
- Electrical throttle control
- Exhaust gas monitoring (OBD II)
- EU IV compliant



233_021

Specifications

Code:ATF (transversely mounted),
A-platform
ASU (longitudinally mounted)
Passat
Type:4-cylinder in-line engine
Displacement:1984 cm^3
Bore:82.5 mm
Stroke:92.8 mm
Compression
ratio:10 : 1
Firing order:1 - 3 - 4 - 2
Rated output:88 kW (120 bhp)
Torque:175 Nm
Fuel:RON 95 unleaded
RON 91 unleaded
(reduced power and torque)

Overhung-mounted camshaft

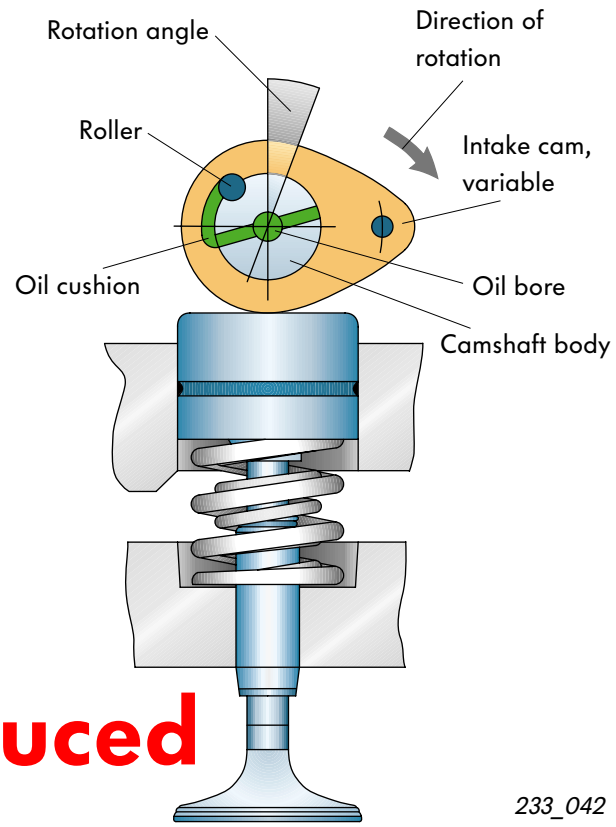
Camshaft timing control

The camshaft timing control operates mechanically with the intake cam overhung mounted.

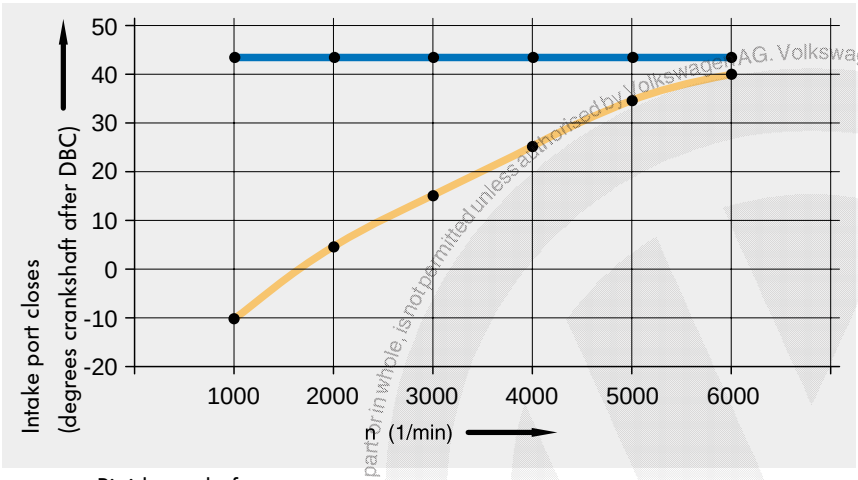
This camshaft – code designation Flino – allows rpm-dependent intake closure.

Advantages:

Better torque delivery across the entire rev band, higher fuel economy and improved elasticity.



233_042



233_043

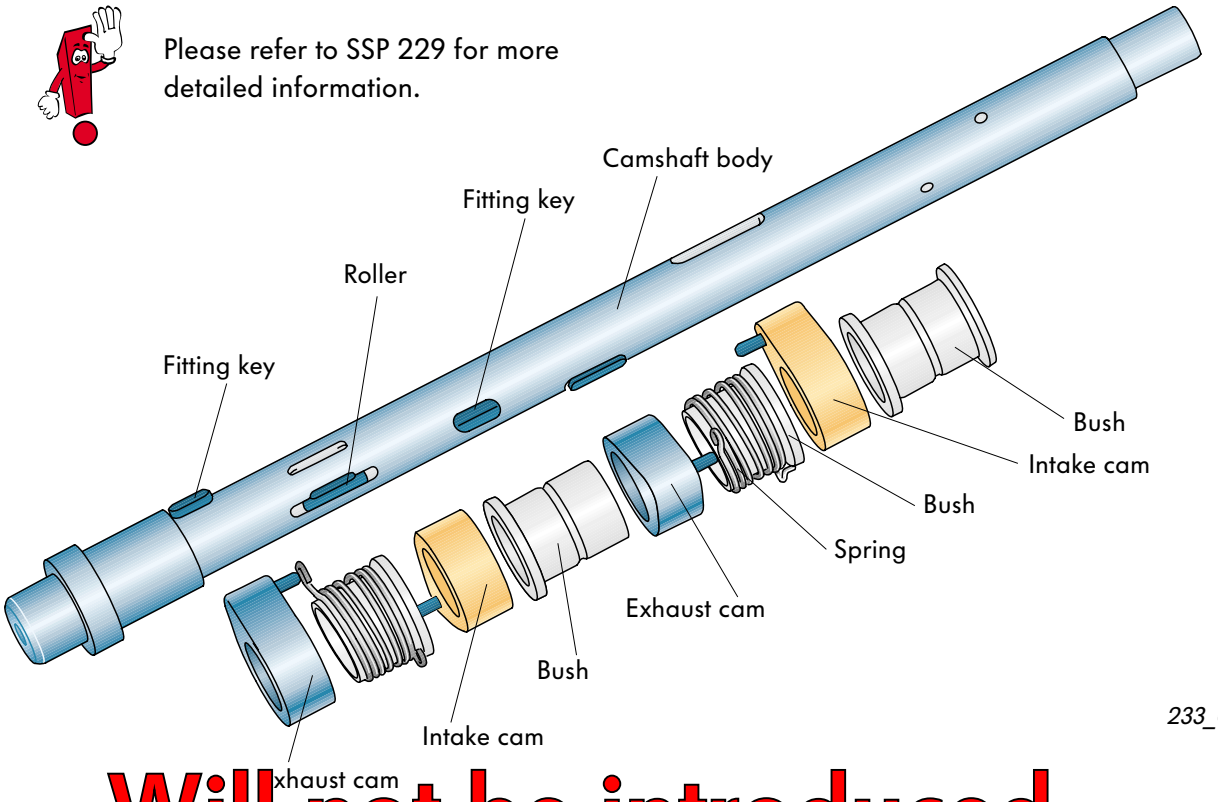
Intake port - closing - position in dependence on engine speed

Function

The opening action at the intake valve is no different to that on a rigid camshaft. During the closing action, however, the cam becomes twisted under the spring pressure exerted by the valve spring.

The rotation angle of the intake cam is dependent on engine speed.
At low engine speeds, the rotation angle is greater than at high engine speeds.

Please refer to SSP 229 for more detailed information.

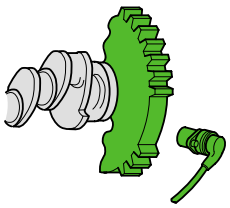


233_044

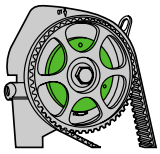
Function	85 kW engine	66 kW engine
Camshaft	The shaft, intake cam and exhaust cam are a single part	A camshaft body with one oil bore aligned longitudinally and transversely in relation to the intake cam. Exhaust cam with fitting key securely connected to the body. Intake cam mounted rotatably on body. An inserted roller drives the cam and limits the angle of rotation. Oil pressure is applied to the empty space in the cam above the camshaft body. The oil cushion dampens the rotary motion and absorbs noise.
Adjustment	none	The intake cam is turned depending on engine speed. It rotates under the force exerted by the valve spring in the direction of rotation of the camshaft, but more quickly than the camshaft itself rotates. The cam "flies" ahead of the camshaft.
Timing	The exhaust port and intake valve have fixed timings	The exhaust valve has a fixed timing The intake valve has a fixed timing for the start of the opening movement and a variable timing for the end of the opening movement.

System overview - ATF/ASU

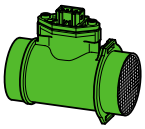
Engine speed sender G28



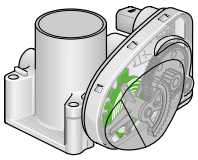
Hall sender G40



Hot film
air mass meter G70 and
intake air temperature sender G42

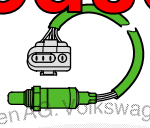


Throttle valve control unit J338
(EPC positioner)
Angle senders for throttle valve
drive G187 and G188

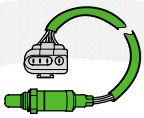


Accelerator position senders G79 and G185

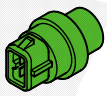
Lambda probe G39



Lambda probe after catalytic converter G130



Coolant temperature sender G62

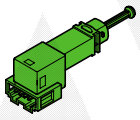


Knock sensor I G61

Knock sensor II G66

Clutch pedal switch F36

Brake light switch F and
brake light switch F47

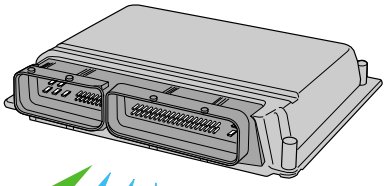


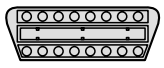
Auxiliary signals:
Air conditioner compressor ON
A/C ready
Road speed signal

CAN-Bus +

CAN-Bus -

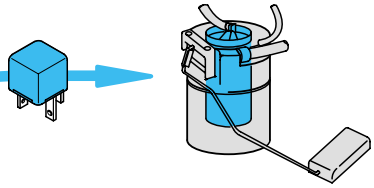
ATF = J220 control unit
Motronic ME 7.5
ASU =J361 control unit
Simos 3.2



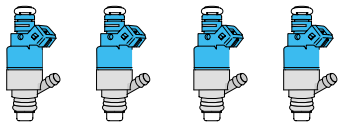


Diagnostic connection

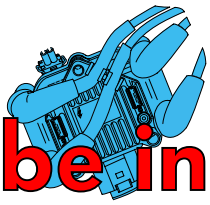
Self-diagnosis of fault warning lamp K83



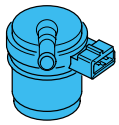
Fuel pump relay J17
Fuel pump G6



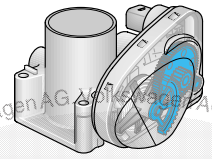
Injectors N30 ... N33



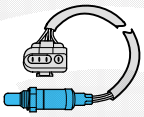
Ignition transformer N152



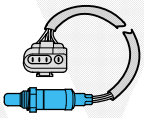
Activated charcoal filter system solenoid valve 1



Throttle valve control part J338 with throttle valve drive G186



Lambda probe heating Z19



Lambda probe heating 1 after catalytic converter Z29

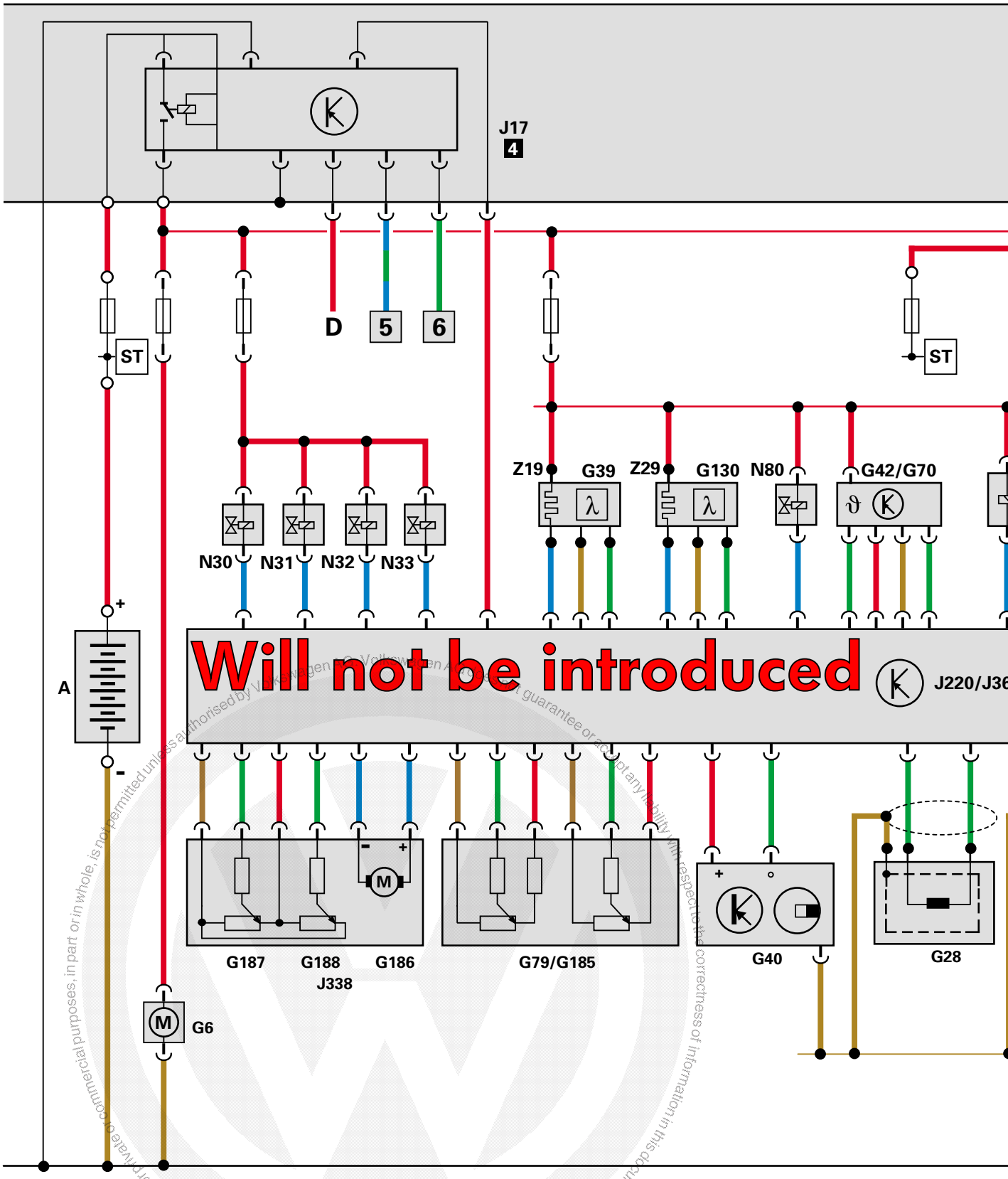
Intake manifold change-over valve N156

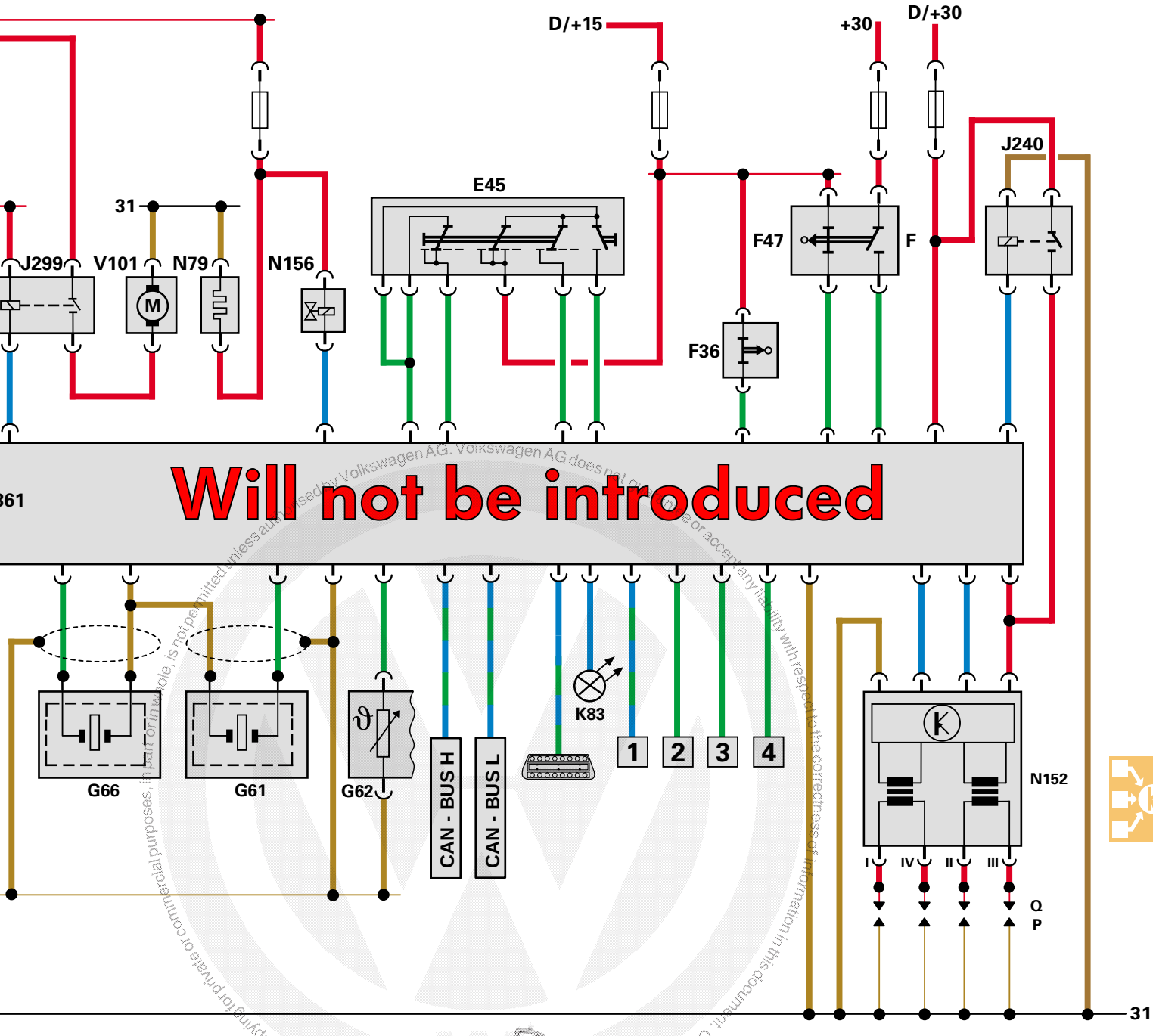
Secondary air pump relay J299 and secondary air pump motor V101

Auxiliary signals:
Air conditioner compressor OFF
EPC fault indicator lamp
Cruise control system
Fuel consumption signal

233_023

Function diagram - ATF/ASU





in out

233_025

Legend for Function Diagrams

The Function Diagram represents a simplified current flow diagram.

It contains information on the links between the Motronic 5.9.2 engine management system for the 2.0 l/85 kW (code AQY or ATU) and 2.0 l/88 kW (code ATF or ASU) engines and the Motronic ME 7.5 or Simos 3.2 engine management system.

Auxiliary signals

1	Air conditioner compressor On/Off
2	A/C ready (in)
3	Road speed signal
4	Fuel consumption signal
5	Rotary latch switch, driver's door
6	Airbag

Colour codes/Legend

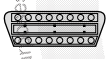
= Input signal

= Output signal

= Battery positive

= GND

= Bidirectional



= Diagnostic connection

Parts

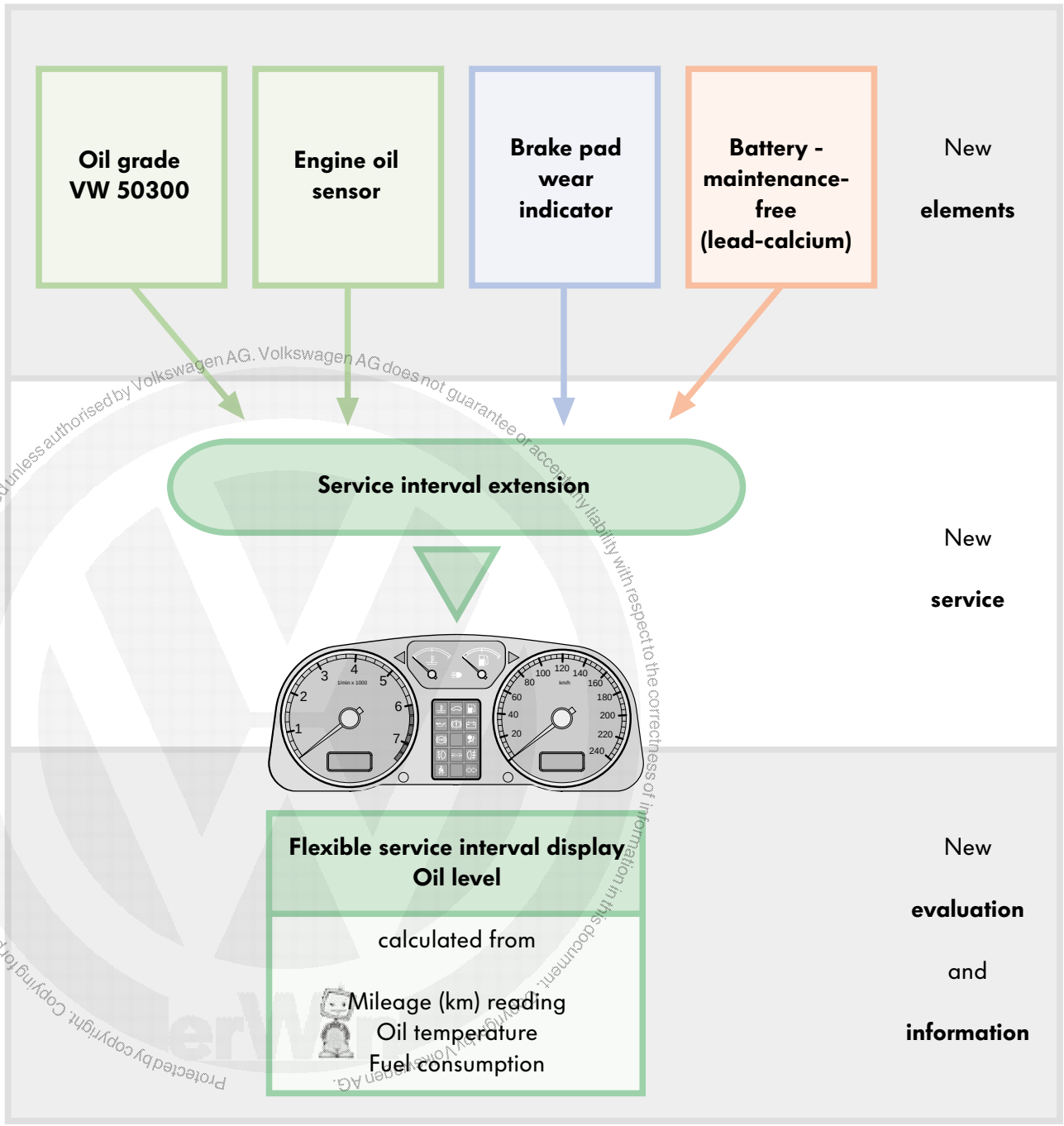
A	Battery
D	Ignition switch
E45	CCS switch
F	Brake light switch
F36	Clutch pedal switch
F47	Brake pedal switch for CCS
F60	Idling speed switch
G6	Fuel pump
G28	Engine speed sender
G39	Lambda probe (upstream of catalytic converter)
G40	Hall sender
G42	Intake air temperature sender
G61	Knock sensor I
G62	Coolant temperature sender
G66	Knock sensor II
G69	Throttle valve potentiometer
G70	Air-mass flow meter
G72	Intake manifold temperature sender
G79	Accelerator pedal position sender
G88	Throttle valve positioner Potentiometer
G108	Lambda probe II
G130	Lambda probe (downstream of catalytic converter)
G185	Accelerator pedal position sender -2-
G186	Throttle valve drive (electric throttle operation)
G187	Throttle valve drive angle sender -1-
G188	Throttle valve drive angle sender -2-
J17	Fuel pump relay
J220	Motronic control unit
J299	Secondary air pump relay
J338	Throttle valve control unit
J361	Simos control unit
K83	Self-diagnosis fault warning lamp
N30...33	Injectors
N79	Heating resistor (crankcase breather)
N80	Activated charcoal filter system solenoid valve 1
N112	Secondary air inlet valve
N122	Output stage
N152	Ignition transformer
N156	Intake manifold change-over valve
N157	Ignition transformer output stage
O	Distributor
P	Spark plug socket
Q	Spark plugs
S	Fuse
ST	Fuse carrier
V60	Throttle valve positioner
V101	Secondary air pump motor
Z19	Heater for lambda probe (upstream of catalytic converter)
Z28	Heater for lambda probe 2
Z29	Heater for lambda probe 1 (downstream of catalytic converter)

Maintenance interval extension

System components for service interval extension

The 88 kW engine has technical features which extend the vehicle's maintenance intervals. This has both economical and ecological benefits. In addition to the new engine production technology (reduced bearing clearance, precision honing), these features include a new type of oil and an engine oil sensor.

Customers can fully utilise the period up to the next service in accordance with their individual driving style and conditions of use. The oil level and service requirements are indicated to the customer visually.



233_045

The LongLife engine oil

This oil is a specially developed, non-ageing quality multi-purpose oil which conforms to the VW standard.

It can be used as an all-weather oil–except in extremely cold climatic zones–withstands higher loads for longer and is of a higher grade than conventional oil.

First Fill Service:

VW 50300

233_046

The oil change interval within the service interval extension service is **2 years or max. 30,000 km**

for the 2.0-litre petrol engine

Oil change intervals

The exact point in time at which the oil change takes place varies from one vehicle to another. The oil change interval is determined as a factor of fuel consumption, driving style and oil temperature and is indicated on the dash panel insert.

Fuel consumption is reduced by 3%.

- These engine oils are the prerequisites for service interval extension. Only these oils should be used to refill the engine.
- No more than 0.5 litres of a different oil type may be mixed with these engine oils.

See also SSP 224.

Maintenance interval extension

Sender for oil level/temperature G266 (engine oil sensor)

The sender for oil level/temperature is installed at the bottom of the engine oil sump.

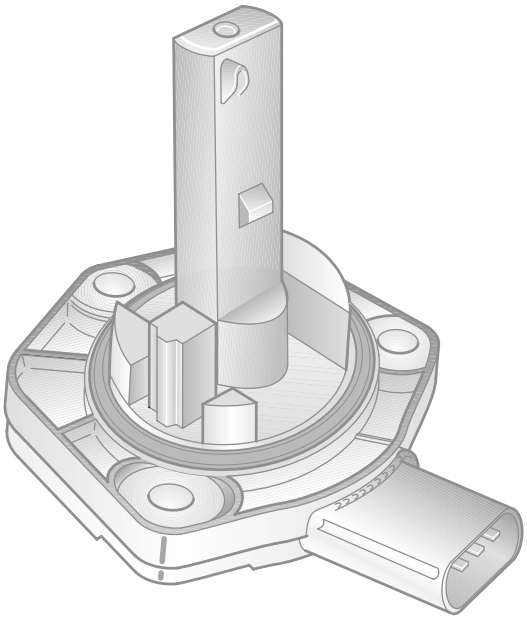
When the ignition is turned on, filling level and temperature data are acquired continuously.

These data are sent to the control unit for the display unit in the dash panel insert in the form of an output signal.

Here, they are processed together with other input variables for the flexible Service Interval Display.

In addition to oil level and oil temperature, fuel consumption in l/h per cylinder, the mileage reading and bonnet opening (via the bonnet contact) - as an attribute of an oil refill - are used for the flexible Service Interval Display.

The present condition of the engine oil in the vehicle is determined in the dash panel insert by evaluating these influencing factors. The upper limit values are variably adapted until the next service.
The system indicates to the driver that the next oil service is due 3,000 km before the next service interval elapses.



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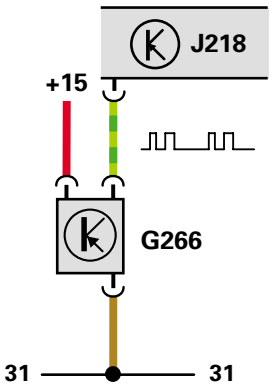


233_048

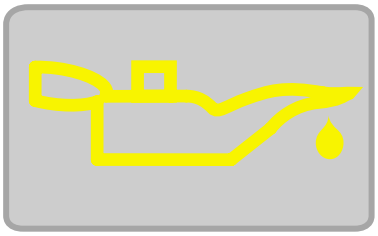
G266Sender for oil level/temperature
J218Control unit for display unit in dash panel insert

Oil level indicator

The conventional warning lamp for engine oil pressure is also used as an oil level indicator.

If the yellow LED is continuously on
= oil level too low

If the yellow LED is flashing
= sender for oil level defective



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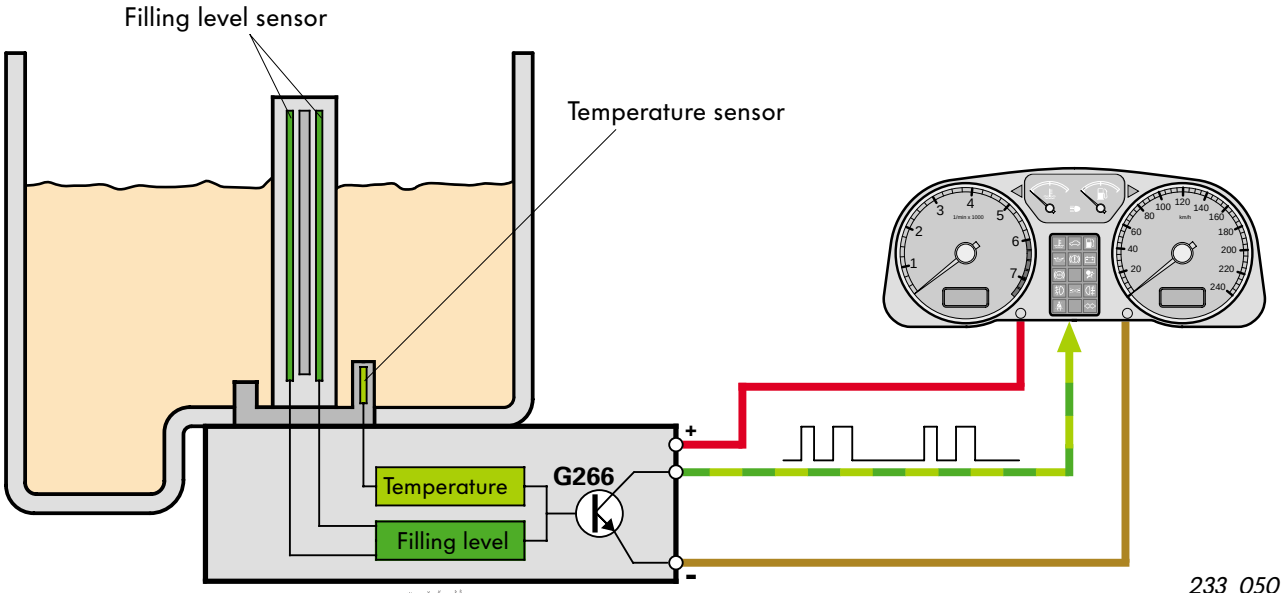
An excessively high oil level is not indicated.



233_050

Signal waveform and evaluation

The measuring element is briefly heated via the present oil temperature
(output = High) and then cools down again (output = Low).

This procedure is repeated continuously. The High times are dependent on the oil temperature and the Low times are proportional to the filling level.

Oil level

The oil level can be calculated in mm from the cool-down time during the cool-down phase by means of a sensor equation. The calculation is accurate to approx. ± 2 mm.

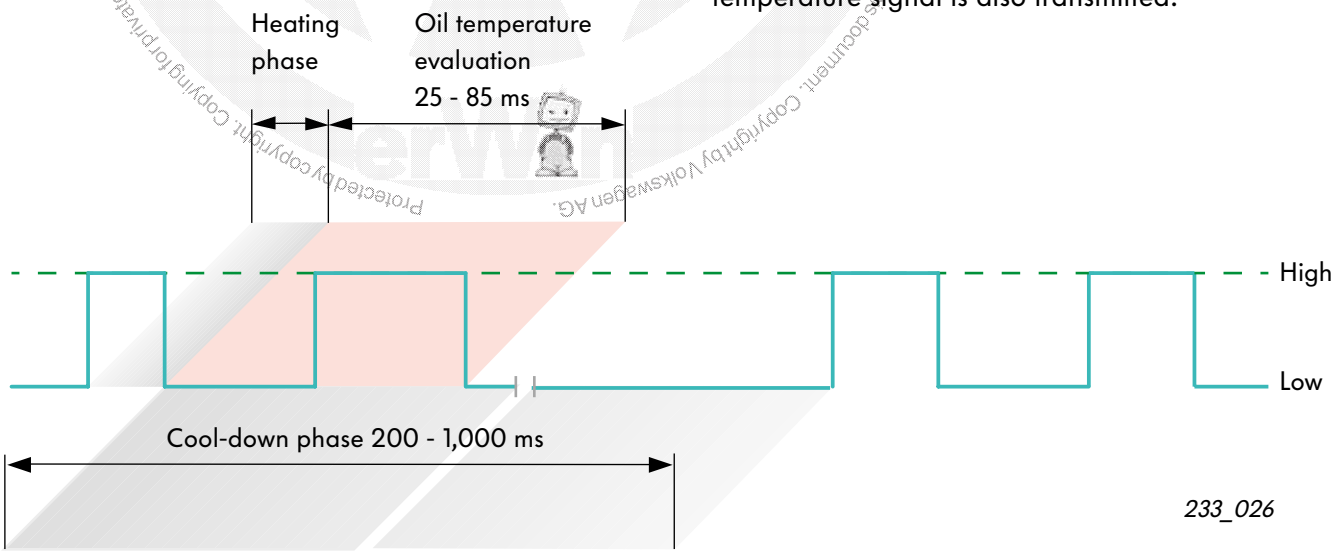
The more oil there is in the oil sump, the quicker the sensor will cool down again.

Long cool-down time = low oil level

Short cool-down time = normal

Oil temperature

During the cool-down phase of the sensor, the oil temperature signal is also transmitted.



233_026

Test your knowledge

Which of these answers is/are correct?
Sometimes only one answer is correct.
However, more than one or all of the answers may be correct.
Please fill in the gaps.

1. The position of the camshaft in the AQY engine is indicated by Hall sender G40.
   It has

   A. a measurement window with the same width for each cylinder,
   B. four different measurement windows,
   C. two narrow measurement windows and two wide measurement windows

   which generate a characteristic signal for each 90° crankshaft rotation .

2. The injectors of the AQY engine are

   A. identical to those used in the 1.6-litre and 1.8-litre engines.
   B. also fitted with an air shroud.
   C. of the so-called “top feed” type.

3. The crankcase has a breather to compensate for pressure differences.
   The mixture of gas and oil vapour is ..... recirculated.
   To prevent the mixture condensing on entry, the inlet is heated. This process takes place

   A. throughout winter operation.
   B. continuously when the ignition is "on".
   C. during the starting cycle (much like a diesel glow plug).

4. By injecting additional air (secondary air) into the exhaust gas,the pollutants in the exhaust gas are recombusted.
   As a result,

   A. the catalytic converter reaches its operating temperature quickly.
   B. the pollutant components CO and HC are reduced.
   C. the engine runs with an air surplus.

5. The secondary air system is

   A. continuously active.
   B. only active during the cold start phase.
   C. active during the cold start phase and in the idling phase after a warm start.
   D. featured in both engines.

6. The combination valve in the secondary air system on the ATU engine

A. is activated electro-pneumatically by the engine control unit.
B. is a vacuum controlled pneumatic valve.
C. is a pneumatic valve which is activated by a separate electro-pneumatic valve.

7. The advantages of the twin-probe lambda control are:

A. Quick and precise lambda control.
B. The conversion efficiency of the catalytic converter is checked.
C. Malfunctioning of the catalytic converter is detected by comparing the probe voltages with a setpoint.

8. The readiness code

A. indicates that diagnoses are in progress to ensure vehicle operation in conformity with the prescribed emission limits.
B. indicates faults in the exhaust emission control system.
C. can be generated and read out.

9. The new Motronic 5.9.2 is a generation of engine control units featuring

A. technical improvements for starting the engine, low fuel consumption and reduced exhaust emission.
B. technical control systems for intake air temperature stabilisation.
C. meeting the requirements for OBD II.

10 . The ATU and AQY engines have different

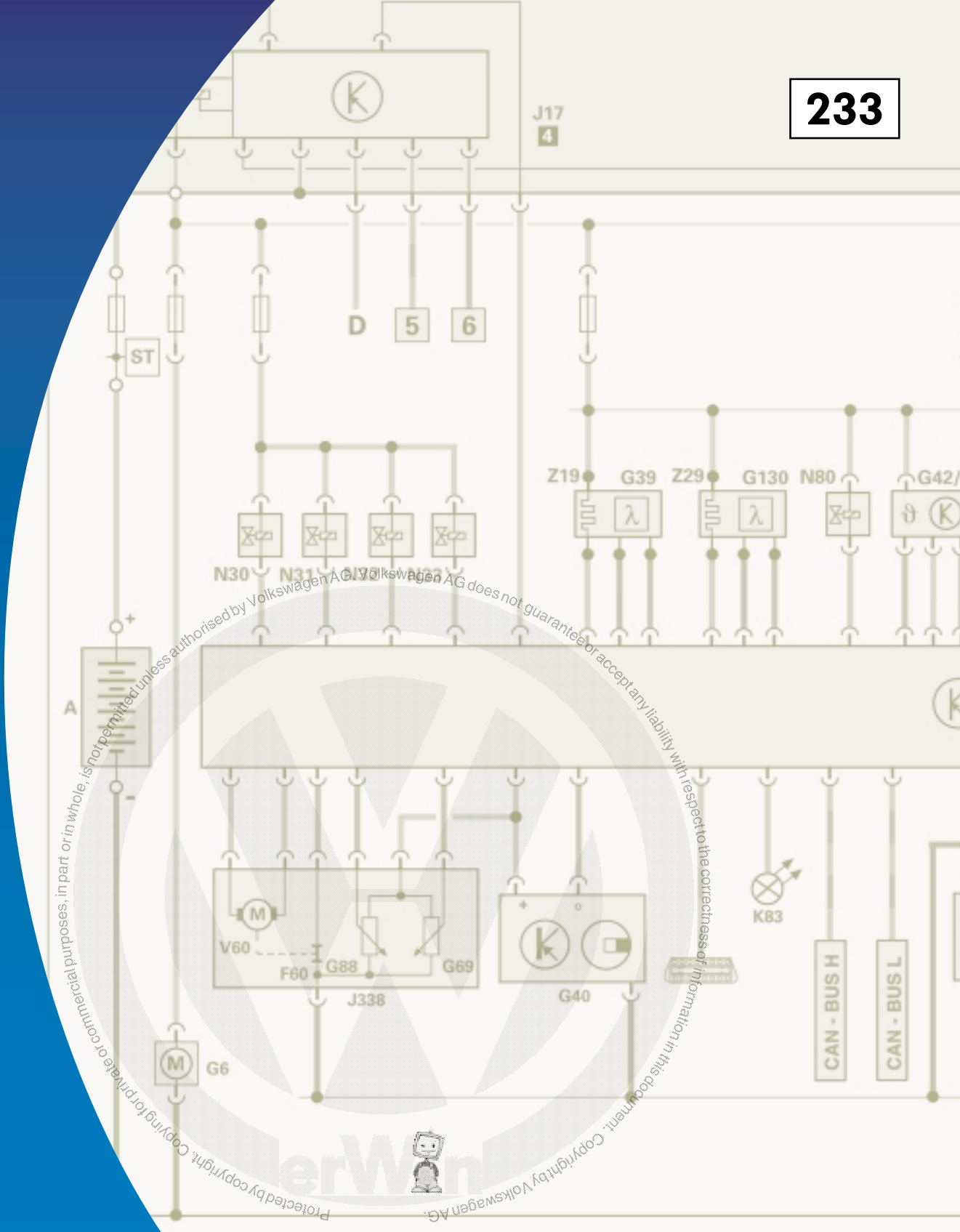
A. distributors.
B. engine mounts.
C. numbers of knock sensors.

Solutions

1. C.; 2. B., C.; 3. in the intake manifold, B.; 4. A., B.; 5. C., D.; 6. C.; 7. A., B., C.; 8. A., C.; 9. A., C.
10. A., B., C.

Service.

233



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