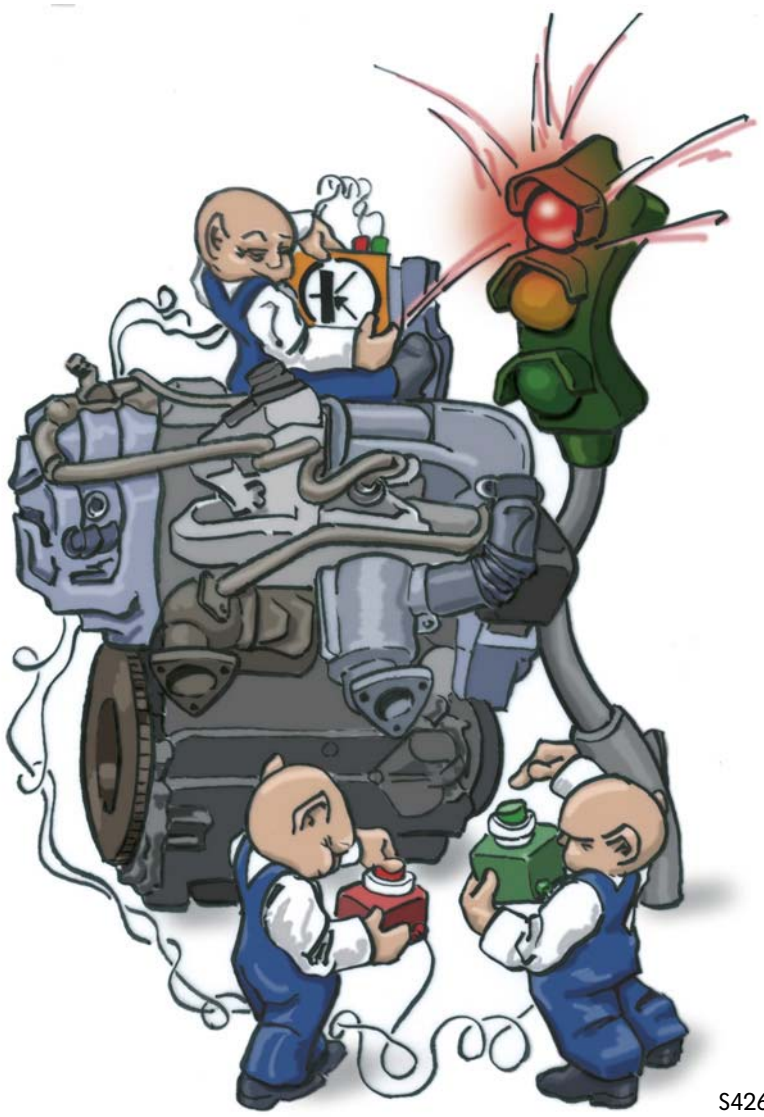
Service Training

Self-study Programme 426

Start/Stop System 2009

Design and Function

Rising fuel prices and stricter emissions laws have made it necessary for us to look for ways to save energy and reduce exhaust gas emissions in vehicles. With this in mind, a start/stop system has been developed that automatically switches off the engine while the vehicle is standing at traffic lights or railway crossings. When you resume your journey, the engine is started again without you having to turn the ignition key.



S426_091

The start/stop system 2009 that is looked at in this self-study program applies to engines using the normal concept of starter and alternator in conjunction with manual and dual clutch gearboxes.
It is being used for the first time in the Passat BlueMotion.

The self-study programme shows the design and function of new developments.
The contents will not be updated.

For current testing, adjustment and repair instructions, refer to the relevant service literature.

Important Note

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Introduction

In line with increasing efforts to counteract global climate change, Volkswagen has already developed its own CO_2 group strategy.
It has been given the name BlueMotion and has now reached the BlueMotion II generation.

The first generation of the CO_2 group strategy was launched under the name BlueMotion I in 2006.
The aim of this first BlueMotion programme was above all to reduce fuel consumption with mechanical modifications and thus reduce harmful emissions.
The following measures were taken as part of BlueMotion I:

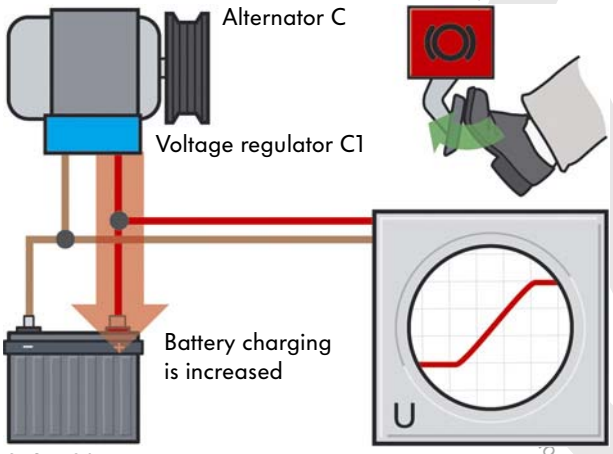
- Improved aerodynamics, particularly on the underbody
- Reduced rolling resistance
- Reduced rpm level
- Fuel saving of 0.6 or 0.7 (estate) litres per 100 km with minimum additional costs
- Lower exhaust gas values
- Body lowered by approx. 15 mm at the front and approx. 8 mm at the rear
- "Plus" multifunction display with gear shift recommendation
- Ratio of specific gears modified compared with standard
- Modified spread of gears
- Steel wheels 6½ J x 16 with Trendline wheel trims
- Improvement in tyre running properties (best-in-class energy tyres: 205/55 R 16 Conti Premium Contact 91H)
- Tyre inflation pressure increased by 0.3 bar

The BlueMotion II concept will then be launched in 2008 on the basis of BlueMotion I.
It expands the existing and already successful measures with the following topics that will arise over the course of this and the coming years:

- Regeneration (energy recovery during braking)
- Low-friction drive shafts
- Tyres with low rolling resistance (economy tyres)
- Flow-forming steel wheels
- Economy gear (gear configuration in gearbox)
- Start/stop system

We will provide you with a brief overview of these topics in the following section.

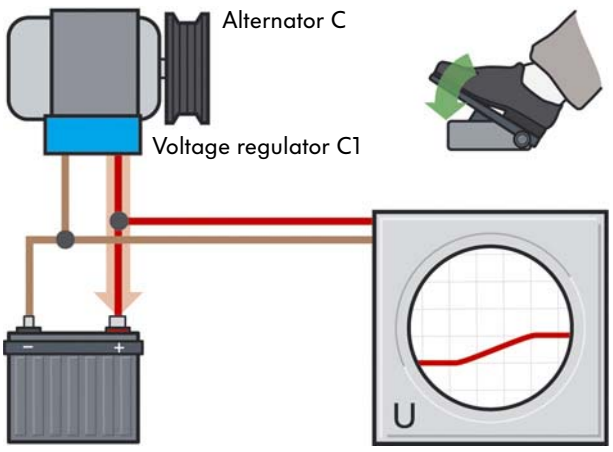
Raising the alternator voltage during braking phases



S426_081

Charge voltage

Reduction in alternator voltage in acceleration phases



S426_082

Charge voltage

Regeneration

Within the framework of the BlueMotion II scope, a further function will also be carried out that has been assigned the term regeneration. In this case, regeneration involves the recovery of energy. This means that energy is recovered by the system and is used to charge the battery. This reduces fuel consumption.
In detail, this function has been configured so that the alternator voltage is raised in the deceleration and braking phases. This leads to increased charging of the battery. This supports the deceleration of the vehicle.
The alternator load is thus reduced in acceleration phases. This relieves the burden on the engine and thus reduces fuel consumption.

Low-friction drive shafts

Special material modifications have allowed the smooth-running properties of the drive shaft bearings to be improved thanks to lower frictional resistance. Less friction means less energy loss and thus lower fuel consumption.

Economy tyres

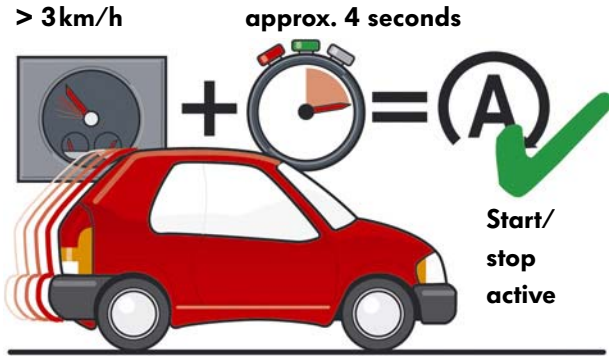
It has been possible to further reduce the rolling resistance of the tyres by improving the material properties. The engine power of the vehicle therefore has to overcome less tyre rolling resistance to accelerate the vehicle. This helps save fuel.

Flow-forming steel wheels

Flow forming is a forging method in which an extremely high density rim well base is drawn from a machined blank using a roller under very high pressure.
The interaction of pressure, the rotation speed of the roller and the temperature of the material define the loading capacity and running properties of the wheel rim. Due to the higher density that is achieved during forging, rims with a quieter ride and, at the same time, lower weight compared with traditional steel rims can be manufactured.
This feature of the wheels reduces the fuel consumption.

Economy gear

Since the top gear has been configured with a higher ratio in the BlueMotion gearboxes, the engine speed is reduced compared with conventional gearboxes.
Reducing the engine speed reduces the CO_2 emissions as well as the fuel consumption.



S426_002

Start/stop system

The start/stop system is part of the BlueMotion II package. It is used to reduce the consumption by automatically switching off the engine while the vehicle is stationary and then starting it again automatically when the driver wants to drive off.
The start/stop mode is activated automatically as soon as the vehicle has travelled at a speed of at least 3km/h for around four seconds after pulling away.

The start/stop system is operated via the engine management and is integrated into the engine control unit software. The start/stop system is planned for the following engines:

- 2.0l TDI CR engines delivering 81 and 103kW
- 1.6l TDI CR engine delivering 77kW
- 1.4l TSI engines delivering 90 and 110kW

It is important for the start/stop system to assess whether the charge state of the starter battery will allow the engine to be restarted. This procedure is called starting voltage prediction. It indicates that all properties and values of the engine related to another engine start are evaluated.
Therefore the battery condition and the engine map are constantly analysed.

On the basis of the starting voltage prediction, it is decided whether the start/stop mode can be used or whether certain electrical consumers should be switched off so that the power requirement is not further increased.
This currently concerns the seat heating, the rear window heating, the mirror heating, the steering wheel heating and electrical preheater. They are switched off before the engine is restarted and for the period of the engine start of the engine start.

Introduction

It was possible to create the start/stop system 2009 with only a few new components. These include the battery monitor control unit J367 and the start/stop operation button F416.
It was, however, also necessary to adapt some components, for example, the starter motor and the alternator for use with the start/stop system.

You will find examples of components and systems that have been adapted for BlueMotion use in the following table.

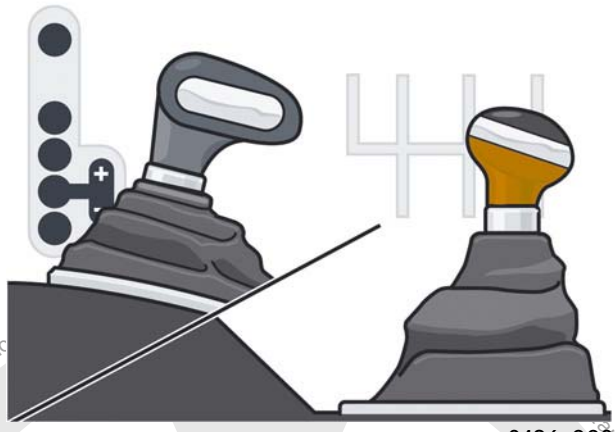
Component/system	**Modifications made**
Control units (general)	- Program code of control units expanded by one information bit for the start/stop system (concerns control units that act on the start/stop system or are influenced by it.)
Alternator	- LIN connection to the diagnosis interface for data bus
Battery	- Absorbent glass mat battery to increase cyclical resistance
Starter	- Higher wear resistance
Vehicle electrical system	- Battery monitoring via a separate battery sensor on the minus pole of the absorbent glass mat battery - New battery wiring - Battery monitor control unit connected to the data bus diagnostic interface via LIN data bus
Manual gearbox	Gear detection sensor G604 - currently: sensor with analogue signal output - planned from calendar week 22/09 as sensor with pulse width modulated signal output

You will find further information on Volkswagen start/stop systems in the following self-study programmes:
No. 58 “Stop/Start Automatic”,
No. 218 “The Lupo 3L” pages 30 and 31
No. 371 “The 2.5-ltr. TDI-Engine in CRAFTER” pages 55 to 57

When purchasing spare parts, please make sure you use the correct designations in ETKA.

Operating concept

The start/stop system is available both for engines with manual gearbox and also for engines with dual clutch gearbox. Both gearbox types have different operating characteristics. There are therefore different operating and function procedures within the start/stop system for both variants.



S426_003

Deactivating the start/stop system

If the driver does not want to use the start/stop system, he can switch it off using the start/stop operation button.
The active symbol for the start/stop system disappears from the dash panel insert display.
Re-activate the function by pressing the button again.

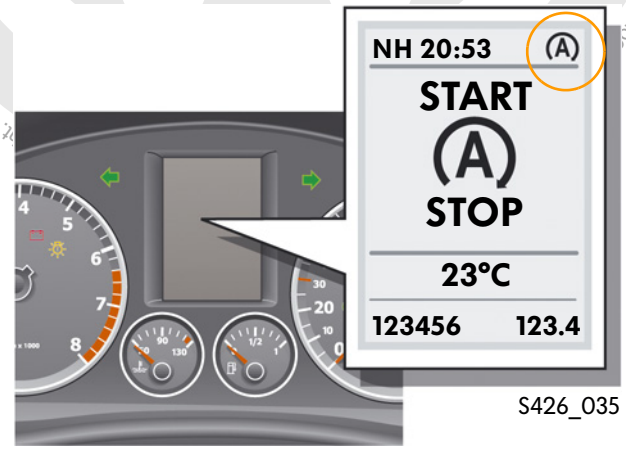
If the ignition key is removed and inserted again, the start/stop mode will be activated automatically.
If the vehicle is travelling at a speed above 3km/h, the start/stop system will be active.

The operating button is in the centre console in front of the gear selector lever.

The start/stop operation button F416 is fitted in place of the button for the ACC adaptive chassis control.

S426_031

Active symbol
Start/stop system



S426_035

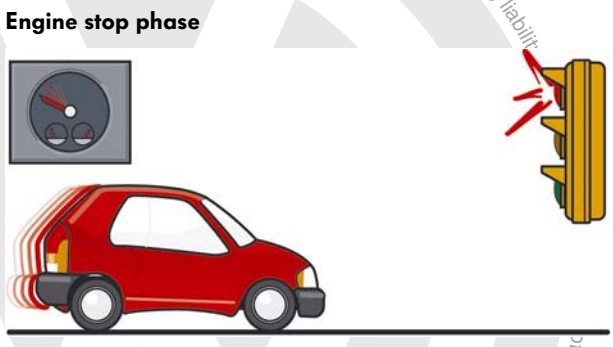
Dash panel insert display (Highline version)

The display in the dash panel insert varies depending on the convenience equipment in the vehicle.
See also the chapter “Display concept” on page 24 of this self-study programme.

Start/stop operation with manual gearbox

The operating procedure is described with the following example.

The vehicle approaches a red light at 50km/h.

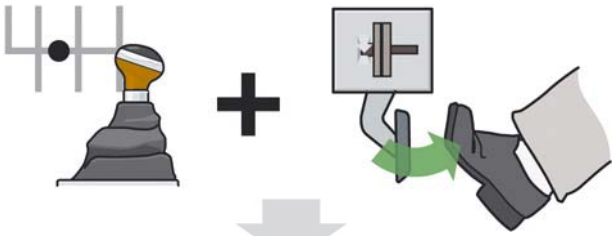


S426_050

The driver shifts down and brakes the vehicle to a stop.

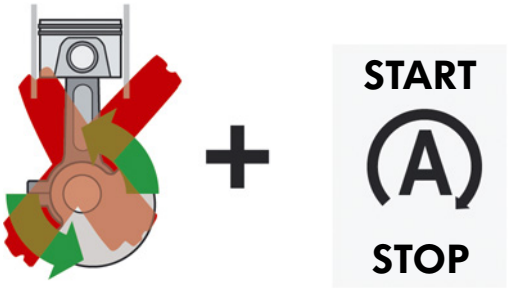
S426_051

He lets the engine idle and releases the clutch pedal.



S426_060

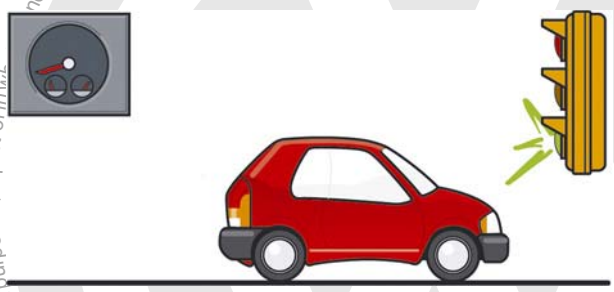
The start/stop system switches the engine off.
The readiness to restart is indicated on the dash panel insert display by a start/stop symbol.



Engine is off.

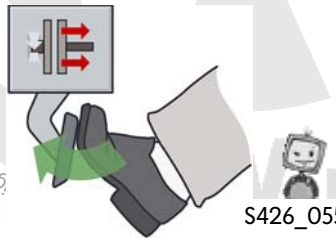
S426_052

Engine start phase



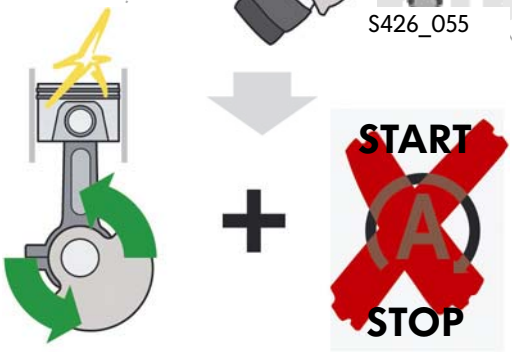
S426_054

The traffic lights switch to green.



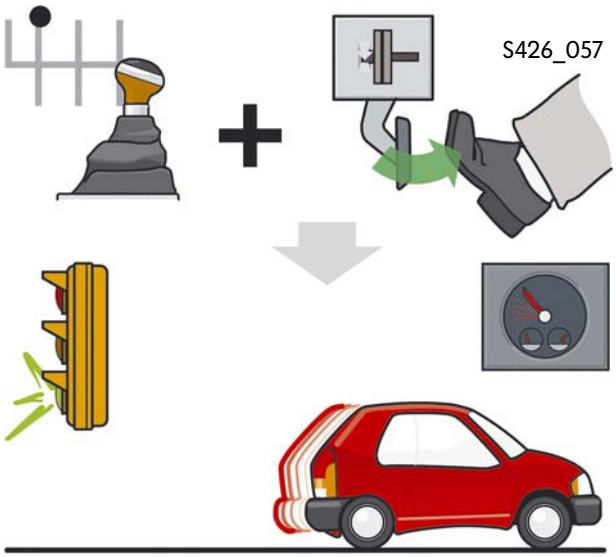
S426_055

The driver depresses the clutch pedal.



S426_056

The start/stop system switches the engine on again automatically. The start/stop symbol in the dash panel insert display disappears.



S426_057

S426_058

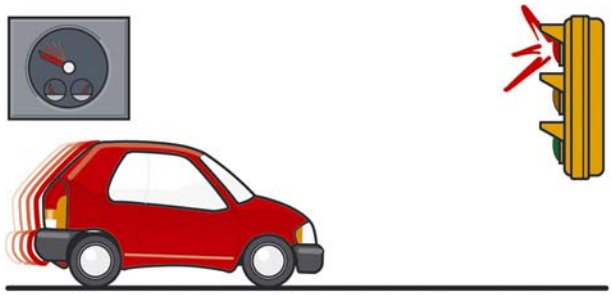
The driver selects a gear, accelerates the vehicle and continues his journey.

Start/stop operation with dual clutch gearbox

The operating procedure is described with the following example.

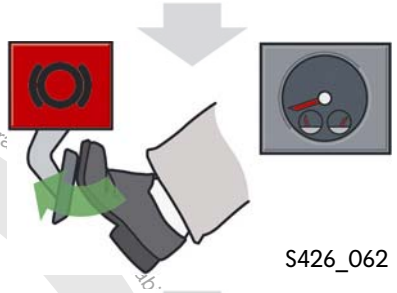
Engine stop phase

The vehicle approaches a red traffic light at 50km/h.
The driver brakes until the vehicle comes to a stop.



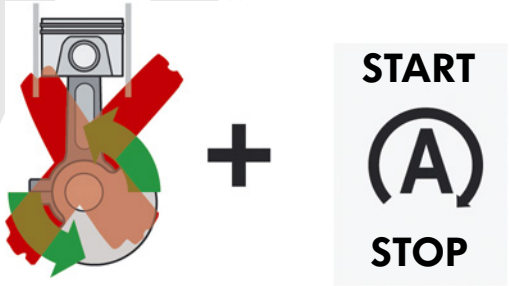
S426_061

The driver keeps his foot on the brake pedal.



S426_062

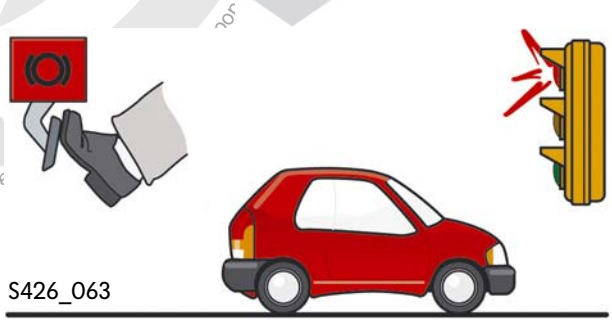
The start/stop system switches the engine off.
The readiness to restart is indicated on the dash panel insert display by a start/stop symbol.



Engine is off.

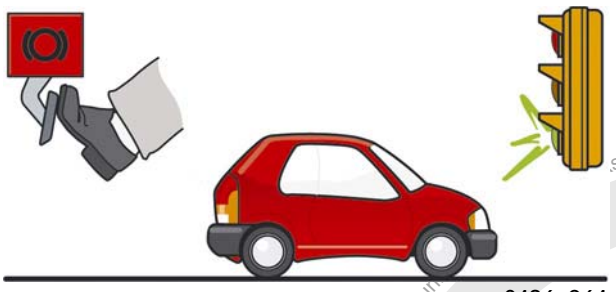
S426_052

The driver keeps his foot on the brake pedal until the traffic lights switch to green.



S426_063

Engine start phase

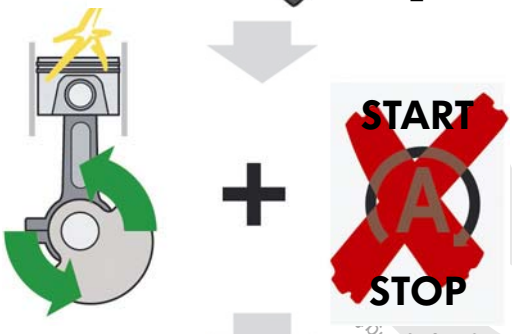


S426_064

The traffic lights switch to green.

S426_065

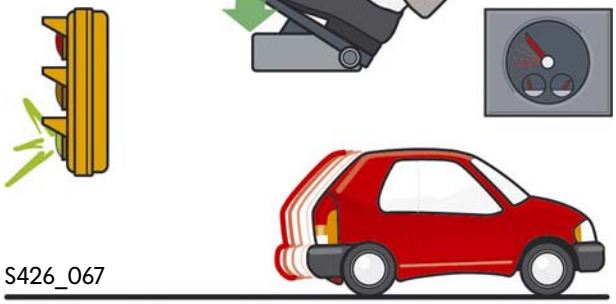
The driver releases the brakes.



S426_056

The start/stop system switches the engine on again automatically. The start/stop symbol in the dash panel insert display disappears.

S426_066



S426_067

The driver presses the accelerator and continues his journey.

The start/stop system uses a number of signals to check its switch on and off conditions and perform its function. You will find further information about this in the chapter “System communication” on page 16 of this self-study programme.

System Overview

Start/stop system schematics

The start/stop system is accommodated as a function in the engine control unit software. The system itself accesses a number of vehicle components and subsystems to control the start/stop mode.

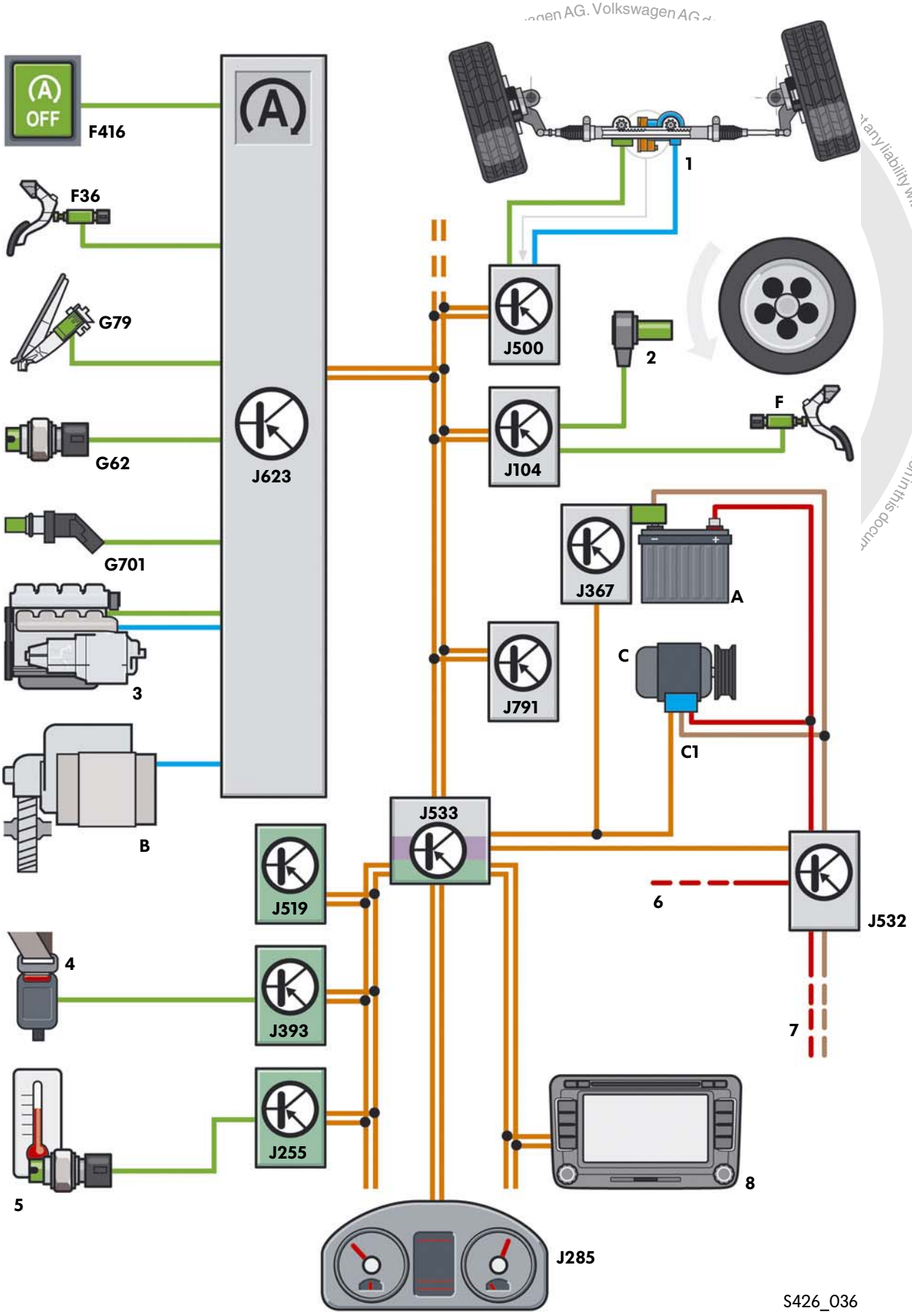
The following schematic diagram shows the necessary vehicle components, of which some have been specially adapted for BlueMotion usage.
However, a great deal more information is required to coordinate the start/stop mode with other vehicle systems and check the conditions for the start/stop system.
These will be shown over the next pages.

Legend
Example of system set-up for manual gearbox

A	Battery
C	Alternator
C1	Voltage regulator
B	Starter
F	Brake light switch
F36	Clutch pedal switch
F416	Start/stop operation button
G62	Coolant temperature sender
G79	Accelerator position sender
G701	Gearbox neutral position sender (manual gearbox only)
J104	ABS control unit
J255	Climatronic control unit
J285	Control unit in dash panel insert
J367	Battery monitor control unit with battery sensor
J393	Convenience system central control unit
J500	Power steering control unit
J519	Onboard supply control unit
J532	Voltage stabiliser
J533	Data bus diagnostic interface
J623	Engine control unit
J791	Control unit for parallel parking assist

1	Electromechanical power steering
2	Speed signal, travel recognition
3	Engine management systems (e.g. ignition, fuel supply, mixture preparation, exhaust gas recirculation, secondary air injection, exhaust gas cleaning, etc.)
4	Seat belt recognition
5	Heating, fan, air-conditioning control
6	Terminal 50R
7	Terminal 30
8	Radio, radio/navigation system

- CAN data bus cable
- LIN data bus cable
- Plus wire
- Earth wire
- Sensor, input signal
- Actuator, output signal
- Powertrain CAN data bus
- Convenience CAN data bus
- Infotainment CAN data bus



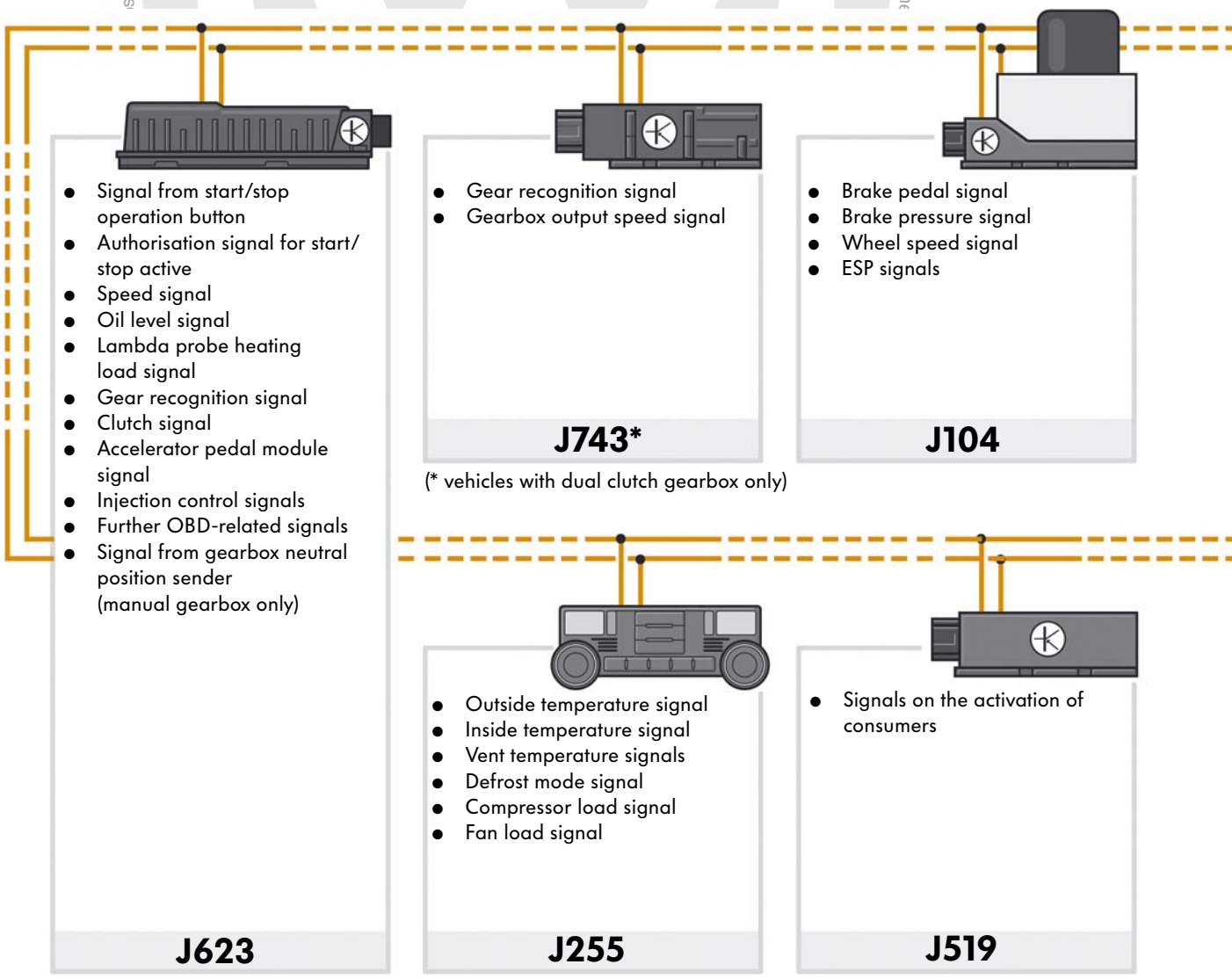
S426_036

System communication

As shown in the previous chapter, much more information is processed by the engine control unit for the start/stop system than just the signals from the accelerator and brake pedal.

The function logic system first needs to establish after "ignition on" whether the conditions have been met to activate start/stop mode. The engine control unit needs to coordinate the operation of the start/stop system with other vehicle systems.
Since the engine is started more frequently than on vehicles without start/stop system, the battery voltage and the charging by the alternator need to be monitored. The voltage supply for the radio, radio/navigation unit, interior fan and the dash panel insert also need to be stabilised at approx. 12V by a voltage stabiliser while the engine is restarted. The usual comfort should be maintained for the occupants.

CAN data bus communication

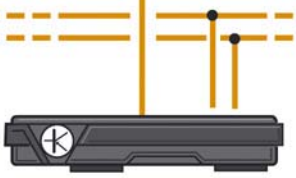


Legend

J104	-	ABS control unit
J285	-	Control unit with display in dash panel insert
J255	-	Climatronic control unit
J367	-	Battery monitor control unit with battery sensor
J393	-	Convenience system central control unit
J500	-	Power steering control unit
J533	-	Data bus diagnostic interface
J519	-	Onboard supply control unit
J623	-	Engine control unit
J743	-	Mechatronic unit for dual clutch gearbox (DSG only)
J791	-	Control unit for parallel parking assist
	-	CAN data bus
	-	LIN data bus

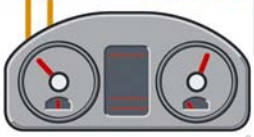
J367

- Battery condition
- Battery operating state
  - Battery voltage
  - Battery current
  - Battery temperature



- Signal current requirement
- Generator load signal (via LIN data bus)
- Battery state
- Voltage stabiliser signal

J533



- Speed signal
- Display control

J285

- Recognition seat belt lock engaged
- Convenience function load signals (e.g. sliding/tilting sunroof drive)

J393

- Electromechanical power steering load signal
- Parallel parking system operation
- Steering wheel movement signal

J791/J500

Please note:
This diagram also only shows a selection of the information that is exchanged by the main control units for operation of the start/stop system.

S426_037

System Conditions

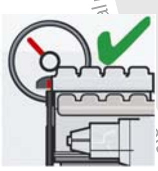
Stopping — Engine stop

To allow the start/stop system to switch off the engine, further conditions need to be met in addition to the control of the clutch, gears and brakes by the driver.

Conditions for engine stop

The vehicle is stationary (speed = 0 km/h).

AND



The engine speed is below 1200rpm.

AND

The coolant temperature is between 25°C and 100°C.

AND

The brake vacuum is more than 550 mbar.

AND

The energy required to restart the engine that was calculated before “engine off” can be supplied by the battery (starting voltage prediction).
The battery temperature is greater or equal to -1°C and less than 55°C.

AND

The air-conditioning requirement of the occupants is not too high.
The difference between target and actual vent temperature is below 8°C.

AND

The diesel particulate filter is not in regeneration mode (diesel engines only).

S426_005, _047, _007, _009, _010, _032, _013

Continuing the journey — Engine start

Specific conditions also need to be met for automatic restarting of the engine by the start/stop system.

Conditions for engine start

The driver is wearing his seat belt (belt lock engaged).

AND

The bonnet is closed.

AND

The driver's door is closed.
(This condition will not be integrated into the system until a later date.)

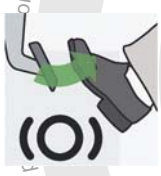
AND on vehicles with manual gearbox

The clutch pedal is actuated.

AND

The gear lever is in neutral position.

OR on vehicles with dual clutch gearbox



The brake pedal is released.

S426_018, _019, _072, _071, _017, _070

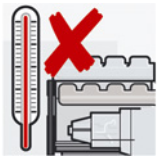
Vehicle requirements — Engine start

The following factors can start the engine without the driver consciously triggering it:

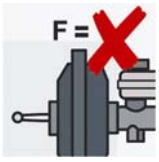
- Change in driving state (e.g. rolling from a stop after releasing the brakes)
- Occupants activating internal vehicle systems (e.g. defrost activated)
- Change to the ambient conditions of the vehicle systems (e.g. outside temperature)

The following conditions can play a part depending on the vehicle equipment:

The vehicle starts to roll from a standstill on a sloping road.
Brake and steering assistance is required.
If the vehicle is rolling faster than 3km/h, the engine will start automatically.



The cooling temperature of the engine is no longer between 25°C and 100°C.



The brake pressure is no longer sufficient.

The charge state of the battery is no longer sufficient.

S426_021, _020, _073, _024, _011

Press defrost button
Increase fan level by more than four steps
Increase the heating or cooling requirement of the air-conditioning system
(target-actual vent temperature difference > 8°C)

To ensure that the engine can be restarted when start/stop operation is active, specific additional consumers or convenience functions like, for example, the seat heating cannot be switched on after the engine has been stopped.

Cancel conditions

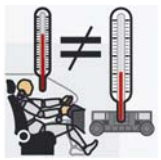
In addition to the previously described influencing variables for an engine stop or automatic engine start, the following conditions prevent activation of the start/stop mode.
The system has the following cancellation conditions:

The start/stop system has been switched off with the start/stop operation button.

The charge state of the battery does not allow the engine to be restarted.
(starting voltage prediction)

The defrost function is active.

The front windscreen heating is active.



The temperature set on the air-conditioning control differs from the actual interior temperature by more than 8°C.

The engine speed is greater than 1200rpm.

The alternator is faulty, e.g. the fan belt is broken.

S426_075, _028, _030, _074, _026, _029, _076

The values listed here depend on the vehicle, equipment and engine.
These details may change due to further technical development.
You can therefore only take the actual values from the current service and workshop literature.

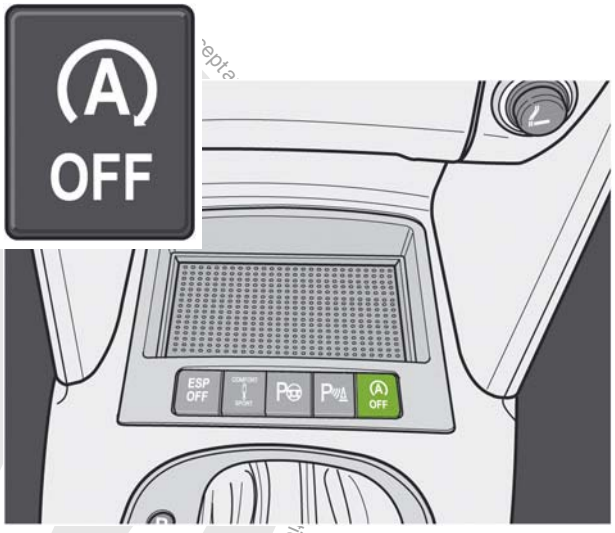
Sensors and actuators

Sensors

Start/stop operation button F416

Location

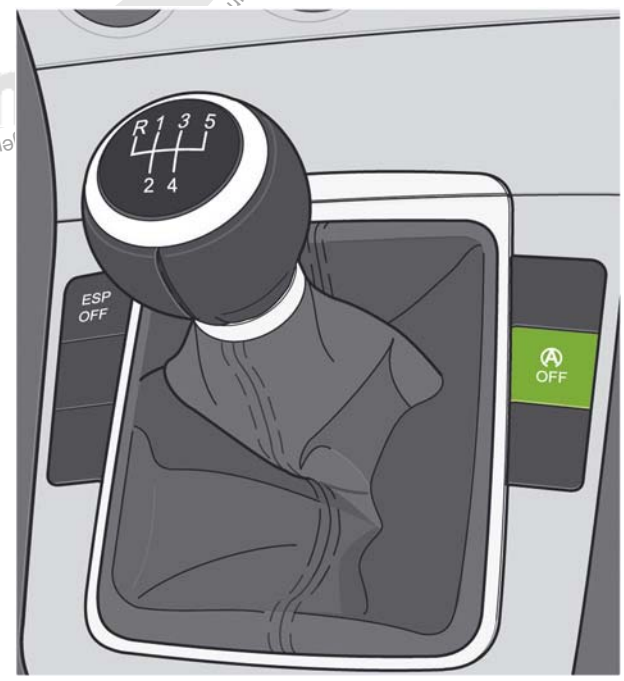
On the Golf 2009, the button F416 is fitted in the row of switches in the centre console in front of the gear selector lever. In the Passat, the start/stop operation button is in the row of switches to the right of the gear lever.



Button F416 in Golf 2009 S426_033

Task

The driver activates or deactivates the start/stop system with this button while driving.
The start/stop system is always activated after a manual “ignition on”. It switches itself on as soon as the previously mentioned operating conditions have been met.

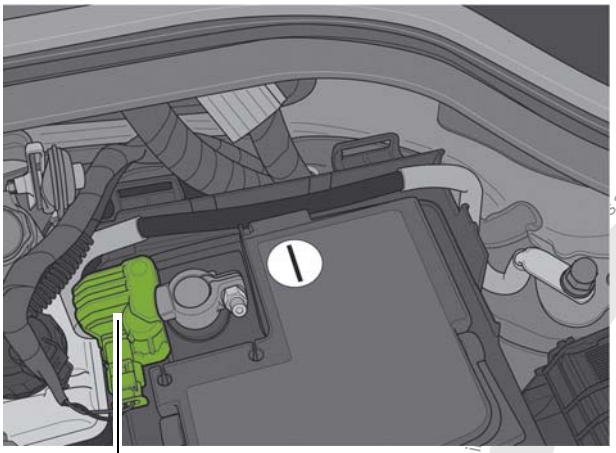


Button F416 in Passat 2009 S426_086

Effect in the event of failure

If the start/stop operation button is faulty, the engine control unit will switch the start/stop system off.
An entry is made in the fault memory of the engine control unit.

Battery sensor in battery monitor control unit J367



S426_088

The battery sensor in the battery monitor control unit on the earth connecting clamp

The information on whether the battery has sufficient electrical energy to restart the engine is an essential condition for operation of the start/stop system.
Therefore BlueMotion vehicles with start/stop system have new wiring to connect the absorbent glass mat battery including a new battery sensor that is integrated in the battery monitor control unit.
This control unit is mounted on the minus terminal of the earth cable and is connected to the diagnosis interface for data bus via the LIN data bus.

Effect in the event of failure

If the battery sensor is faulty, the operating condition of the battery can no longer be assessed correctly.
An entry is made in the fault memory of the data bus diagnostic interface. The start/stop system is switched off.

Signal use

The battery sensor determines the following values:
- Battery temperature
- Battery voltage
- Charging current

The battery temperature is measured using a map and the ambient temperature.
It also allows the duration of the battery load to be determined.
The data obtained allows the charge regulation as well as the charge voltage to be adapted to the charge and operating state of the battery. The aim is to increase the availability of the start/stop system with the detailed data evaluation of the starter battery.

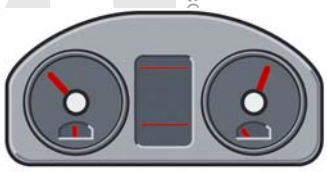
Display concept

Depending on the version of the dash panel insert, the start/stop system is depicted differently with its system messages on the display in the control unit in dash panel insert J285.

Lowline dash panel insert

In the Lowline version, operation of the start/stop system is only indicated when the automatic engine stop has been carried out. The system needs to be in stand-by mode to start the engine again automatically.

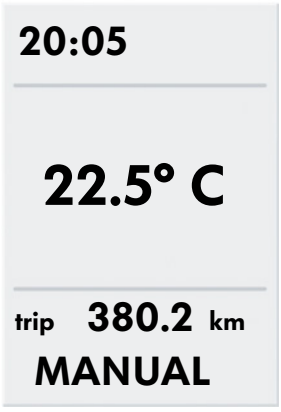
A running text is shown in the lower part of the display stating “START STOP ACTIVE”.



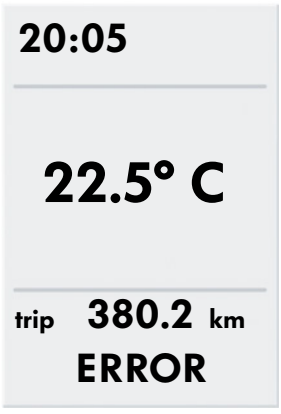
S426_045

If it is necessary for the driver to start the engine manually, the system will display an alternating message saying “MANUAL” and “START”.

If there is a fault in your system that does not allow the stop-start system to be used, the words “START”, “STOP” and “ERROR” will be displayed in succession as a message.



S426_039



S426_039

Highline dash panel insert

This icon indicates that the start-stop system is active.

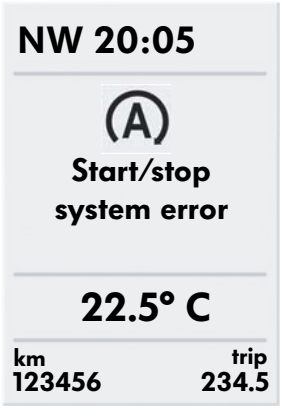
S426_040

In the Highline version, operation of the start/stop system is indicated by the letter “A” inside a circular arrow at the top right of the display. If the driver switches the function off or the operating conditions are not met, this icon will disappear.

If the engine has been switched off by the start-stop system and the system is on stand-by to start the engine again, a large start/stop icon will be displayed in the middle of the screen. The icon disappears as soon as the engine has been started by the start/stop system.

S426_041

If the driver has to start the engine manually, a system message appears in the middle of the display under a small start/stop icon. The message “Start engine manually” appears.



S426_042

S426_041

An error in the system is indicated by the “Start/stop system error” system message in the display. It appears after you start the engine when you start a journey with a faulty start/stop system and is then replaced by the request to start the engine manually.

Specially adapted components and systems

The following components needed to be technically adapted for use with the start/stop system:

- Absorbent glass mat battery
- Alternator
- Starter
- Manual gearbox (gear recognition)
- Voltage stabiliser

These components will be looked at separately later.

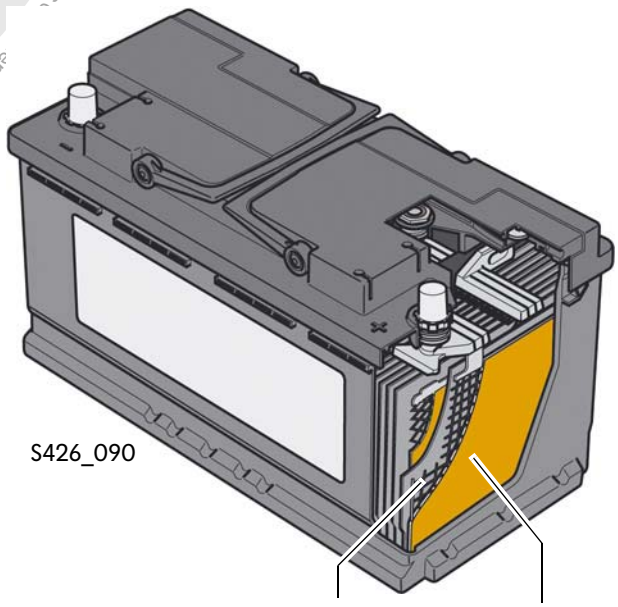
Please observe the correct spare parts designation in ETKA for the repair.
The components adapted for BlueMotion are not labelled specially for and do not or hardly differ on the outside from normal components.

Absorbent glass mat battery

Instead of the normal lead batteries, absorbent glass mat batteries are used exclusively for BlueMotion vehicles due to their high cyclical resistance as starter batteries.

Absorbent glass mat batteries are, alongside gel batteries, among the latest, higher performance developments in the battery field. The basic difference from a lead battery is the acid being completely absorbed in a glass-fibre mat that separates the lead grid electrodes.

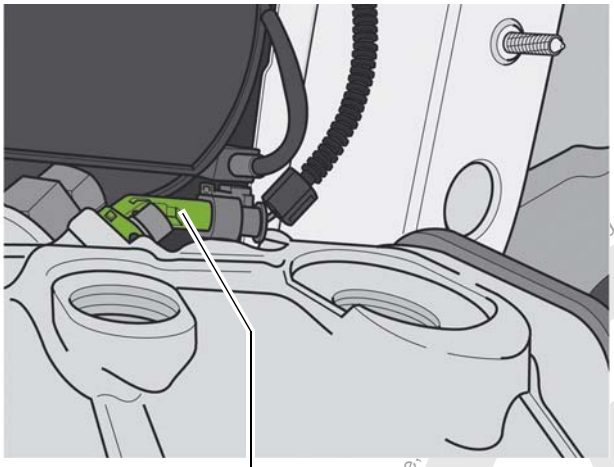
Further advantages are:
- High cold-start performance
- High deep discharge capability
- High functional strength
- Tip and leak-safe even when case damaged
- Very little performance-reducing acid-coat formation compared with conventional batteries
- Maintenance-free



When recharging or jump starting, please observe the following:
First connect the plus pole with the charging lead;
then connect the body earth.
In this way, you ensure that the battery sensor is not bridged.

The direct charging of the battery at the negative pole leads to the battery sensor being bridged.
This means that the battery data is not recorded by the sensor during the charging procedure.
The values for the battery state stored in the data bus diagnostic interface then no longer coincide with the values of the charged battery.

You will find further information on the battery types used by Volkswagen in self-study programme 234 “Vehicle batteries”.



Gearbox neutral position sender G701

S426_087

Manual gearbox

In the development of the start/stop system, a sensor needed to be added to the manual gearbox for BlueMotion vehicles to allow the system to detect when the gear selector lever is in neutral position.
This is the gearbox neutral position sender G701.
It is screwed into the gearbox case from above and detects the position of the selector shaft contact free.

Alternator

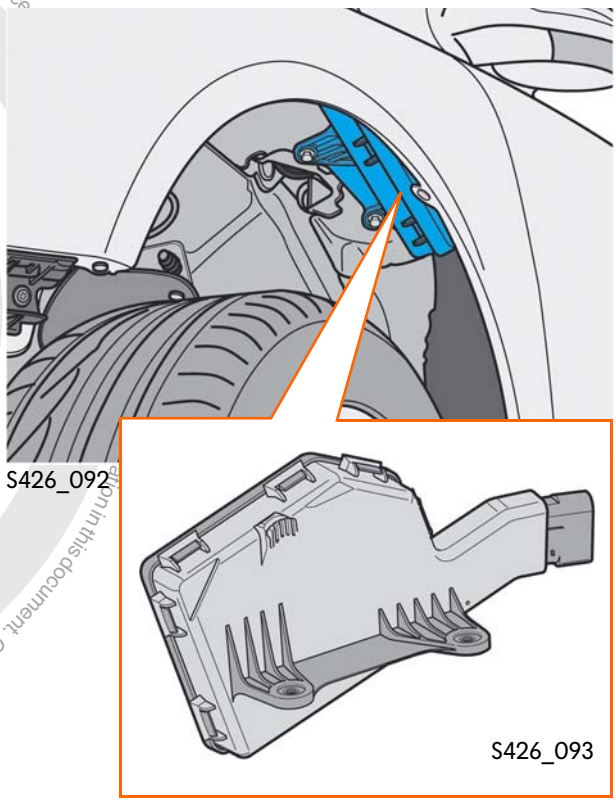
Up to now, the alternator and voltage regulator were connected to the engine and onboard supply control units via separate wires. As part of the BlueMotion technology, information is now transferred to the data bus diagnosis interface via a LIN data bus.
This supplies the information to other control units, like the engine control unit, via a CAN data bus.

Starter

Due to the high demands placed on the starter when the start/stop system is active, e.g. in city traffic, the cyclical resistance has been increased and the ring gear reinforced. A cycle is an operation of the starter regardless of whether the engine starts.
A higher cyclical resistance therefore means that the starter can be used more frequently.
The wear is reduced.

Voltage stabiliser J532

The voltage stabiliser is a DC/DC voltage transformer. DC/DC (DC = Direct Current) means a direct current to direct current voltage transformer. It is on the front left wheel housing and has an output of 180 W.
The voltage stabiliser is electrically operated via the LIN data bus and via the electrical onboard supply (terminal 50R; R stands for return).



S426_092

S426_093

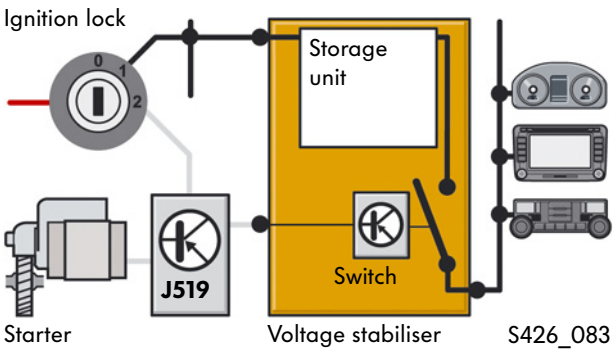
Task

As the name voltage stabiliser suggests, it has the task of stabilising the 12-volt vehicle power supply (terminal 30) at approx. 12 volts in certain situations, for example, start/stop operation. This is necessary as large voltage fluctuations can occur for other electrical consumers in the vehicle due to the high starter current in start/stop operation.
Without a voltage stabiliser, unit resets and fault memory entries, for example, “Vehicle voltage, signal too low”, can occur in the affected control units. This is avoided with the help of the voltage stabiliser.

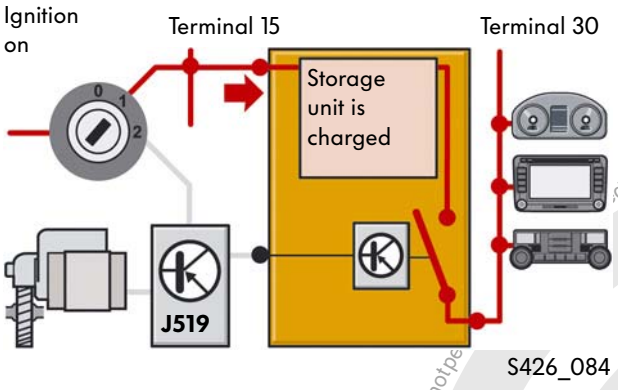
Effect in the event of failure

If the voltage stabiliser is faulty, units like the radio, radio navigation, dash panel insert and telephone will be reset if their own voltage supply is not sufficient due to the starter being operated.
If the aforementioned electrical consumers are reset each time the engine is started during start/stop operation, this indicates that the voltage stabiliser is faulty. A direct entry for a malfunction of the voltage stabiliser, e.g. in the fault memory of the diagnostic interface or onboard supply control unit, is not made at present.

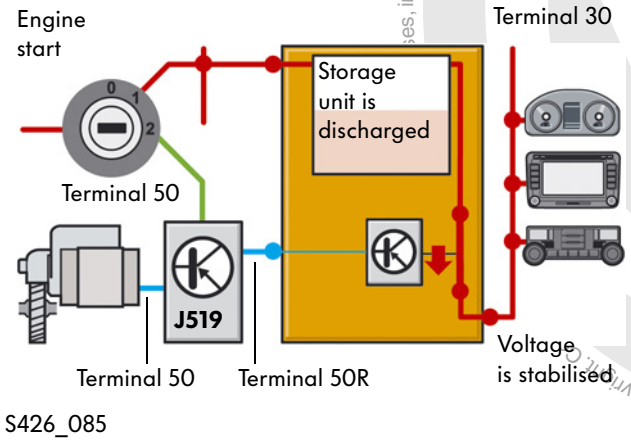
How it works



The voltage stabiliser is a DC/DC voltage transformer. The central element of a voltage transformer is an electronic storage unit that can store electrical energy for a certain period. Furthermore an internal switch (transistor) is required that controls the flow of the electrical energy from the storage unit.



If the ignition lock is set to “Ignition on”, terminal 15 is thus powered and the voltage stabiliser is switched on. The storage unit is charged so that the voltage stabiliser has its full electrical power of 180 watts available to compensate a voltage drop. The internal switch that controls the discharge of the storage unit is open.
The voltage stabiliser is now ready.



When the starter is operated (terminal 50 powered), the voltage stabiliser receives an activation signal (trigger) via terminal 50R (R=return).
The activation signal closes the switch. The stored energy flows from the storage unit and compensates voltage fluctuations. Then the switch opens and the storage unit charges up again.

Test Yourself

Which answers are correct?

One or several of the answers could be correct.

1. What is the purpose of the start/stop system?

☐ a) It stops the vehicle at a red traffic light, switches the engine off and starts it again automatically when the traffic lights switch to green.

☐ b) It helps to save fuel and reduce exhaust gas emissions.

2. What basic conditions need to be met by the driver when stopping at traffic lights for the start/stop system to automatically switch off the engine in a vehicle with manual gearbox? Complete the following sentences.

The driver needs to ..... ,

move the gear lever to the ..... position and release the ..... pedal.

3. What additional factors have a direct influence on operation of the start/stop system?

☐ a) The coolant temperature

☐ b) The ambient temperature

☐ c) The pressure in the brake system

☐ d) The tire pressure

☐ e) Certain settings on the air-conditioning system (e.g. selected temperature, defrost mode)

☐ f) The battery voltage

☐ g) The load

☐ h) The engine speed

☐ i) The exhaust gas treatment on petrol engines (e.g. Lambda value >1)

4. Which statement is correct?

☐ a) Start/stop operation is only possible on vehicles with manual gearbox as it is unsuitable for vehicles with automatic gearbox particularly for vehicles with dual clutch gearbox.

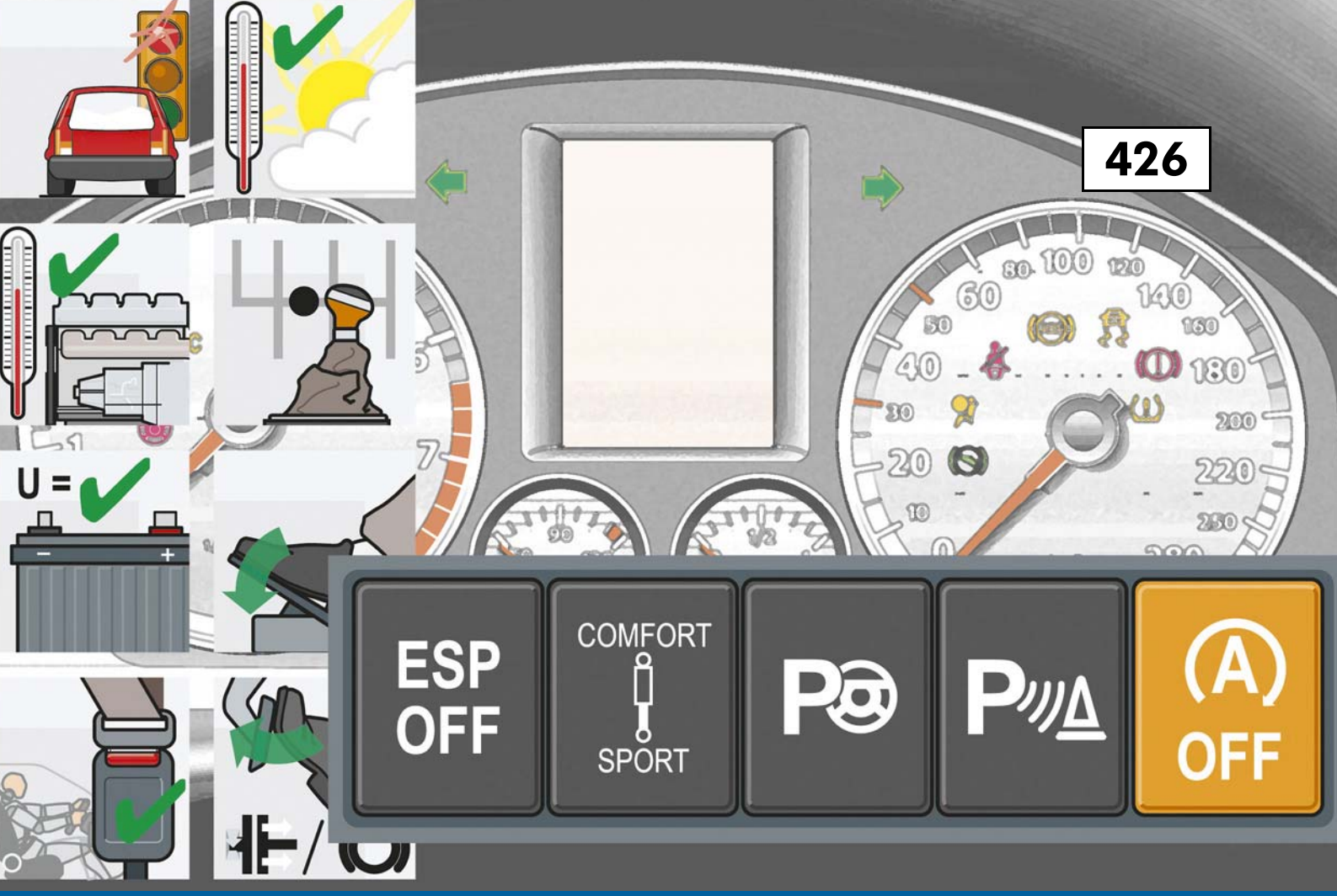
☐ b) Some components in BlueMotion vehicles needed to be technically adapted for operation of the start/stop system, for example, the alternator and the starter battery connection.

☐ c) To allow the start/stop system to work in a vehicle with dual clutch gearbox, the driver needs to hold down the brake pedal even when the vehicle has come to a halt.

☐ d) The start/stop mode can only be activated manually with the start/stop operation button.

☐ e) Faults in the start/stop system are only indicated via the start/start operation warning lamp.

Answers
1. b);
2. The driver needs to brake the vehicle until it is stationary, move the gear lever to the neutral position and release the clutch pedal.
3. a), b), c), e), f), h);
4. b), c)



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