



**Full power for start / stop**  
and all consumer units in the car:  
S5 EFB and S6 AGM from Bosch

 **BOSCH**  
Invented for life

# Energy for innovative systems: S5 EFB and S6 AGM technology from Bosch

## The Bosch batteries for modern demands: S5 EFB technology and S6 AGM technology

- Sources of energy with high performance capability for frequent starts – in particular with start/stop systems
- Connected to the energy management system that monitors the state of charge and temperature of the battery and decided whether a reliable repeat start is possible



Bosch batteries S5 with EFB technology and S6 with AGM technology



Growing traffic volume, rising prices for fuel, and stricter EU standards for the prevention of air pollution through CO<sub>2</sub> reduction represent new challenges for the automotive industry. The Bosch solution: Innovative systems such as start/stop systems, brake energy recuperation, and the powerful batteries to fulfill these requirements.

## New vehicle equipment

More and more new cars in Europe are equipped with start/stop systems. More power and greater deep-cycle resistance are required. The S5 EFB and S6 AGM batteries from Bosch reliably secure the energy supply for vehicles with start/stop systems and a high number of electrical consumer units.

## Start/stop system: No movement – no fuel consumption

When the vehicle is at a standstill and after a check of the state of charge of the battery, the system automatically switches off the internal-combustion engine. The electrical consumer units in the vehicle continue to be supplied during the stop and the current energy consumption is monitored. When the journey is to be continued, operating the clutch automatically restarts the engine. This means that in standstill phases no fuel is consumed and no CO<sub>2</sub> is emitted. The EFB and AGM technologies from Bosch ensure optimal energy supply.

## Brake energy (recuperation)

In the case of brake energy (recuperation), kinetic energy is converted into electrical energy in the overrun mode and stored in the battery. If required, the energy that is recuperated is available to increase engine power and save fuel in that the alternator is switched off temporarily (passive boost).



Lower fuel consumption at red lights

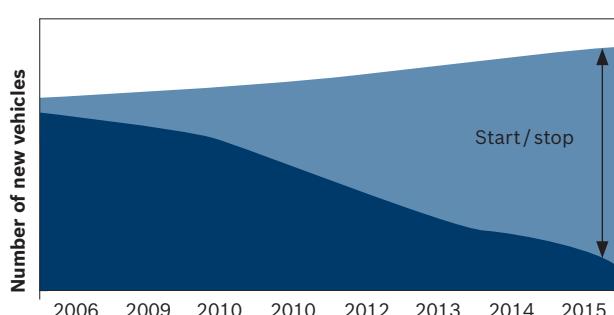
### Less fuel and emission

In addition to personal safety, it is important to Bosch to handle resources economically and protect the environment. Every second in which an internal-combustion engine runs with the vehicle at a standstill means excess consumption of fuel and avoidable emissions. Engine starts with a start/stop system take place very quickly and economically. Measurements in the new European driving cycle (NEDC) indicated savings in consumption and reductions in emissions of around 8%. In real urban traffic, savings can be considerably higher. In conjunction with a modern gasoline engine, a warm start only consumes as much fuel as is consumed in 0.7 seconds of

idling. This means that stops are worthwhile from the first second onwards: For people and the environment.

### New opportunities for the workshop in the battery market

The growing number of vehicles with start/stop systems is changing the way in which car batteries are sold and serviced. The battery is assuming a key role in the system. It is integrated into the functions for fuel saving and reduction of CO<sub>2</sub>. Batteries are no longer replaced with the "do-it-yourself" method. A workshop professional now has to perform this task, as battery replacement often has to be notified to the control unit with the help of a diagnostic tester.



**Increase in revenues for the workshop**  
By 2015, more than 30 million vehicles in Europe will be equipped with start/stop systems. This will create strong demand in the workshop for the corresponding batteries that require professional replacement.

# Power supply for modern systems.

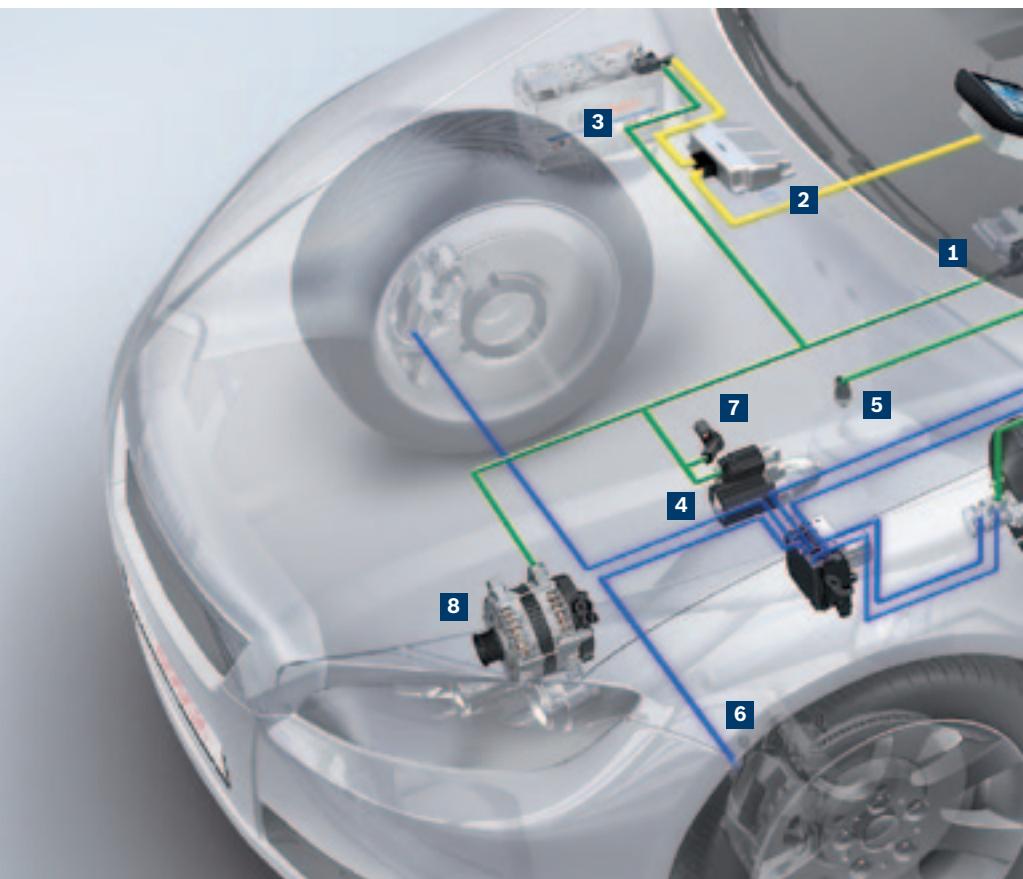
## An exciting and demanding task

### System technology in the car:

**Reliable power supply plays a leading role**

- 1 Engine control unit with software option start / stop
- 2 DC / DC converter 12 V
- 3 Deep-cycle resistant battery (EFB, AGM) and battery sensor
- 4 Start / stop starter motor
- 5 Neutral gear sensor
- 6 Wheel-speed sensor
- 7 Crankshaft sensor
- 8 Alternator with brake energy recuperation

■ Current supply 12V  
■ Communication  
□ Hydraulic lines /  
brake systems



### System know-how from Bosch

Bosch has been working for more than 30 years on the development of hybrid technologies and can rely on comprehensive know-how in the fields of battery, electric drive, and brake management as well as engine and transmission-shift control. Today, the Bosch range of products for automotive systems and components is particularly broad. Start/stop, brake energy recuperation, as well as innovative solutions for energy storage and battery management assume an important position.

### Reliable: Interplay of all components

Essentially, the function of the start/stop system is achieved by adapting and intelligently controlling existing components in the vehicle. The centerpiece is the specially developed start/stop starter motor which has been configured for the special requirements and is networked with the engine control unit. The entire system includes regulation software and a battery sensor as well as a crankshaft sensor and the corresponding sensor technology in the pedals. An enhanced-efficiency alternator in conjunction with a deep-cycle resistant battery enables frequent start and stop operations.

### System functions: Check before automatic engine shutdown

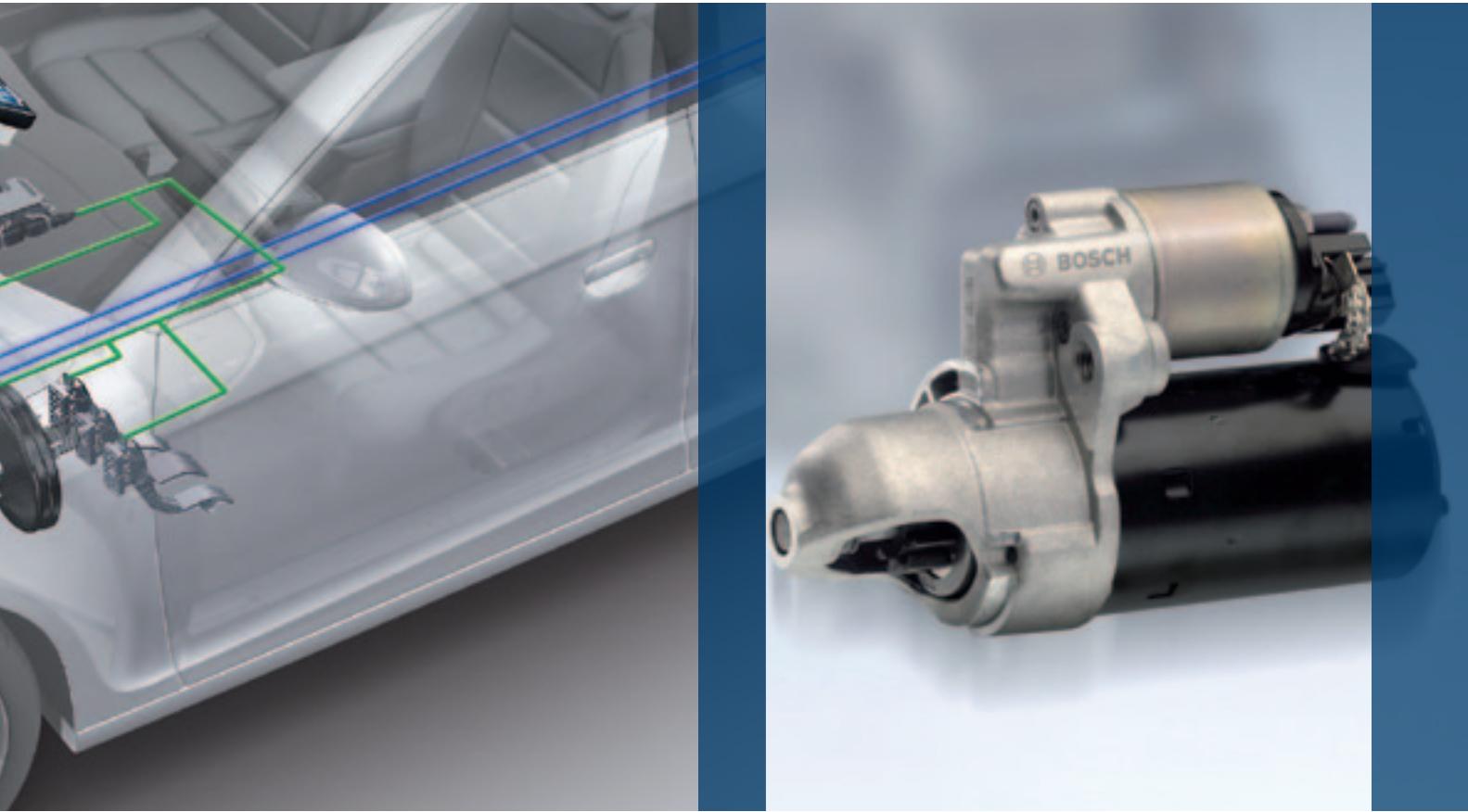
- Engine is in neutral gear (idling)
- The wheel-speed sensor signals vehicle standstill
- The battery management system signals sufficient energy for the next start

### Coordination: Energy management (1 and 3)

The engine control unit with integrated start / stop coordinator and the battery sensor are major components of the energy management on vehicles with a start / stop system. It also includes the deep-cycle resistant battery with EFB or AGM technology and the DC / DC converter.

### Direct current: DC / DC converter (2)

When the starter is activated, the voltage level of the vehicle electrical system falls temporarily. This can impair the function of electronic devices. For example, this can result in a brief interruption in radio reception or loss of the navigation system. To prevent this loss of comfort and convenience, Bosch has developed the direct voltage converter (DC/DC converter) for deployment with



Start/stop starter motor

start/ stop systems. This stabilizes the voltage for parts of the vehicle electrical system during engine start so that comfort and convenience is not reduced.

#### **Monitoring: Electronic Battery Sensor EBS (3)**

The electronic battery sensor EBS is a central part of the electronic energy management. Installed in the terminal recess of the battery, it precisely and dynamically registers operating data such as power, voltage, and temperature. With the measured values, it monitors the performance capability of the battery and determines its capability to store and supply energy.

#### **Information managers: Sensors (5, 6 and 7)**

The sensors provide the control technology with current information and can optimize the starting operation. While the neutral gear sensor indicates whether a gear is engaged, the wheel-speed sensor measures whether the vehicle has really come to a standstill. The crankshaft sensor reports engine activity accordingly.

#### **Reliable electricity supplier: Alternator (8)**

Efficiency Line alternators for start/stop systems generate more electrical energy for supply of the vehicle's electrical system even in the low speed range and directly after the vehicle has been started. In conjunction with the powerful battery, they increase the availability of the start/stop function.

#### **A special boost: Start/stop starter motor (4)**

The starter motor has been optimized for frequent start operations by reinforcing attachment points that are subjected to high loads and improving the transmission.

#### **Comfort in any situation**

The air conditioner and additional electrical functions such as power windows, trunk lid lock, engine cooling etc. represent a burden on the energy system, especially when the engine is switched off. The electronic consumer units are still supplied with power by the battery while the vehicle is at a standstill.

# Comparison of Bosch battery applications.

The right power: For every drive concept



S6 with AGM technology<sup>1</sup> (Absorbent Glass Mat)



S5 with EFB technology<sup>2</sup> (Enhanced Flooded Battery)

## Engine with start/stop system and brake energy recuperation: Full charging for many starts

The deployment of start/stop in conjunction with brake energy recuperation requires a battery with top performance

- ▶ Frequent stops and starts with continued supply of the electrical consumer units during the stop phase
- ▶ Even higher requirements for deep-cycle resistance and discharge level
- ▶ Fast and high charge acceptance
- ▶ High fuel saving and CO<sub>2</sub> reduction
- ▶ Technology employed: AGM<sup>1</sup>

## Engine with start/stop system:

### Many starts need more energy

The start/stop system leads to a completely new load profile for the battery.

- ▶ Frequent stops and starts with continued supply of the electrical consumer units during the stop phase
- ▶ Moderate discharge levels and higher requirements for deep-cycle resistance
- ▶ Fuel saving and CO<sub>2</sub> reduction
- ▶ Technology employed: EFB<sup>2</sup> oder AGM<sup>1</sup>

## Load diagram - battery for start/stop system/recuperation



Characteristic: Many start operations, high load on the battery, additional power called up by passive boost

## Load diagram - battery for start/stop system



Characteristic: Large number of start operations, resulting in higher load on the battery

<sup>1</sup> Binding of all electrolyte in micro-glass-fiber mats

<sup>2</sup> With additional polyester scrim between plate and separator



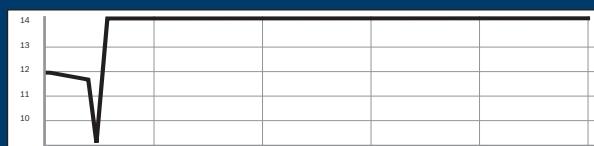
S3, S4 and S5 with PowerFrame® technology

#### **Conventional vehicle drive unit: Start up and it runs**

In conventional vehicles, the battery requirements from charge/discharge cycles are in the "normal" range.

- ▶ Motor start as primary function, subsequently charging by the alternator
- ▶ Low requirements for deep-cycle resistance and low discharge levels
- ▶ No savings in fuel or CO<sub>2</sub> reduction
- ▶ Battery: Conventional lead-acid technology

#### **Load diagram - battery in conventional vehicle**



Characteristic: A start operation followed by recharging

#### **The full range for all battery applications**

Different vehicle concepts put different demands on the starter battery with regard to performance. With its range of batteries, Bosch is equipped to deal with these demands.

#### **For normal engines, start/stop, and energy recuperation**

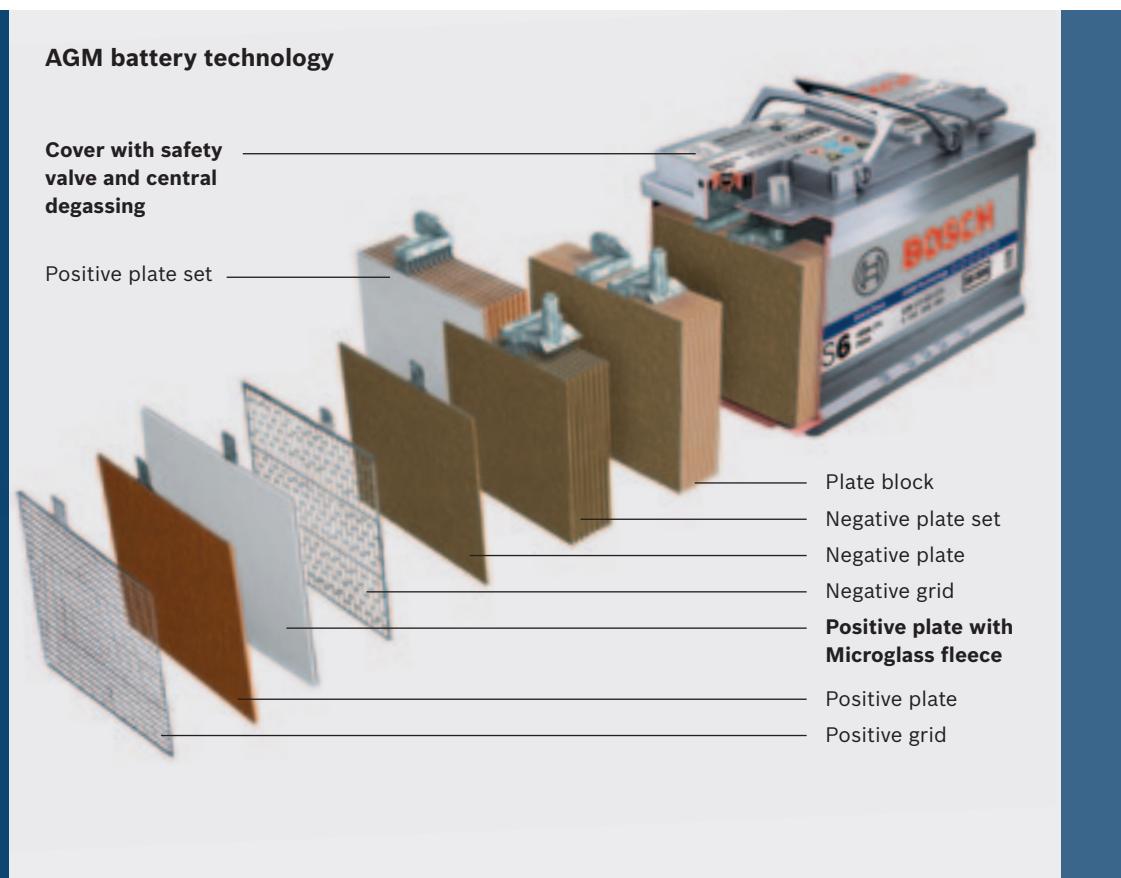
At Bosch, professionals develop batteries for the vehicle market geared towards the latest technical developments and requirements. This means the range is always broad and includes batteries for all applications.



#### **Drivers impressed by Bosch batteries**

The readers of "auto motor und sport" magazine voted Bosch the best brand in the "Batteries" category.

# Constant energy peak: S6 with AGM technology – always supplied

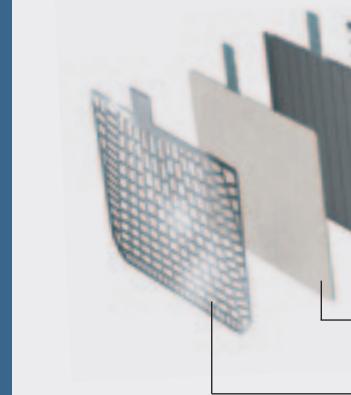


S6 with AGM technology: The powerhouse for the highest energy comfort

## EFB battery technology

Paste with higher density  
and additives for improved  
charge acceptance

Positive plate set



S5 with EFB technology for absolute

## S6 with AGM technology: Peak power for the highest performance

AGM technology (Absorbent Glass Mat) is the top technology on the market. Dynamic recharging capability and up to 4 times the number of discharge/charge cycles compared to conventional starter batteries means that the S6 with AGM technology meets the toughest requirements. This is a must for start/stop systems with brake energy recuperation, but also for vehicles with a high number of electrical convenience functions.

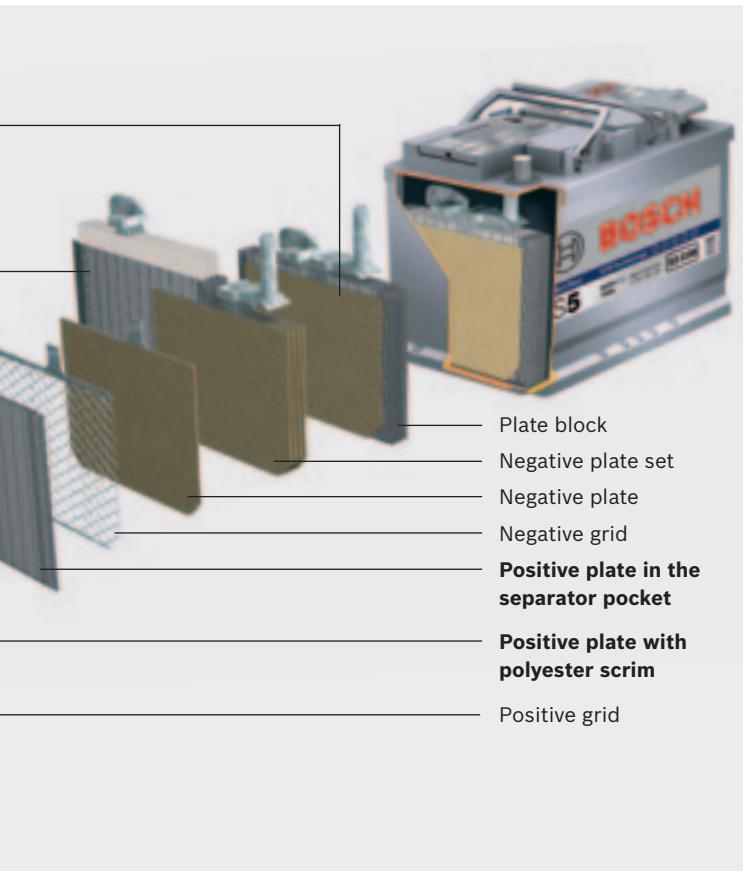
## The advantages of Bosch battery S6 with AGM technology

- ▶ Constant power even for short distances, stop-and-go traffic or high consumption with the car at a standstill
- ▶ Up to 4 times higher deep-cycle resistance in comparison to conventional starter batteries
- ▶ Acid is completely bound in microglass fiber mats
- ▶ Excellent charge acceptance
- ▶ Excellent cold starting power
- ▶ Can be installed in any location, secured 100 % against leaks and tilting
- ▶ Absolutely maintenance-free
- ▶ Original-equipment quality



Special microglass fiber mats are located tightly between the lead plates of the AGM battery and bind in all of the electrolyte. High pressure minimizes loss of the active material with extremely low internal resistance. The faster reaction between the acid and plate material means that higher amounts of energy can pass through in demanding situations.

# Performance beyond high standards: S5 with EFB technology



reliability



Typical of modern cars: An increasing number of electrical consumer units

## S5 with EFB technology: Full power across the entire market

The S5 EFB technology (Enhanced Flooded Battery) from Bosch meets all the demands between conventional starter batteries and S6 AGM technology. In particular, its power is used in modern vehicles with start/stop systems. The high deep-cycle resistance of S5 with EFB technology in particular ensures there is sufficient energy for a repeat start of the vehicle at all times. The high power density is also configured for vehicles with a large number of electrical consumer units.

## The advantages of Bosch battery S5 with EFB technology

- ▶ Reliable start even at extreme temperatures
- ▶ Two times higher cycling performance compared to conventional starter batteries
- ▶ Enhanced charge acceptance
- ▶ With additional polyester scrim between plate and separator
- ▶ Perfect for short-distance urban driving conditions
- ▶ Greater active mass density for better current flow
- ▶ Secured against leaks and tilting up to 55°
- ▶ Absolutely maintenance-free
- ▶ Original-equipment quality



In the case of EFB technology, the positive plate is coated with so-called polyester scrim. This provides additional hold for the active material. The deep-cycle resistance is increased in comparison with traditional batteries and the battery remains ready for deployment even in the event of strong vibrations.

# Professional workshop services:

## Installing batteries safely

In many vehicles with start/stop systems (e.g. Audi, BMW, Volvo), a suitable control unit diagnostics tester, for example a device from the Bosch KTS series, has to be used to replace the battery. The diagnostics tester can be used to perform e.g. the following functions:

- ▶ Programming the new battery into the vehicle
- ▶ Programming technical data, e.g. Ah and product number



### The motor vehicle workshop is the required partner for installation in the case of modern vehicles with start/stop systems

Only the appropriate battery type, replaced and adjusted professionally, ensures the advantages of the start/stop system:

- ▶ Significantly lower fuel consumption and correspondingly reduced CO<sub>2</sub> emissions
- ▶ Increased starting capacity for frequent start operations
- ▶ Delay-free, quiet and convenient vehicle start when driving off again

**With S5 EFB and S6 AGM, your customers benefit more and pay less.**

### Important aspects of battery service for vehicles with start/stop systems

- ▶ Replacement of AGM with AGM
- ▶ EFB with EFB or AGM
- ▶ Conventional lead-acid battery cannot be used.
- ▶ Frequently, deployment of a control unit diagnostics tester is necessary to register the newly installed battery at the control unit

**With the wrong battery type, the function and positive effects of the start/stop system are diminished. The service life of the battery is reduced.**

# Tailored for all systems:

## Overview of Bosch batteries



	S6 with AGM technology	S5 with EFB technology	S3/S4/S5 with PowerFrame® technology
Primary function	<b>Engine with start/stop system and brake energy recuperation:</b> The deployment of start/stop in conjunction with brake energy recuperation requires a battery with top performance.	<b>Engine with start/stop system:</b> Many starts need more energy: The start/stop system leads to a completely new load profile for the battery.	<b>Conventional vehicle drive unit: Start up and it runs</b> In conventional vehicles, the battery requirements from charge/discharge cycles are in the "normal" range.
Technology	AGM Absorbent Glass Mat	EFB Enhanced Flooded Battery	PowerFrame® technology
Start/stop systems		✓✓	✓
Braking energy recuperation		✓	
High number of consumer units		✓✓✓	✓
Frequent short distances		✓✓✓	✓✓
Load diagram			

### S6 batteries with AGM technology

Bosch TTN	ETN	HKB	Power output	Technical details			Box size	Dimensions in mm			Bosch TTN
				Ah	A(EN)	Circuit		Mount	L	B	
0 092 S60 050	560 901 068	S6 005	60	680	0	1	B13	H5	242	175	190
0 092 S60 080	570 901 076	S6 008	70	760	0	1	B13	H6	278	175	190
0 092 S60 110	580 901 080	S6 011	80	800	0	1	B13	H7	315	175	190
0 092 S60 130	595 901 085	S6 013	95	850	0	1	B13	H8	353	175	190
0 092 S60 150	605 901 095	S6 015	105	950	0	1	B13	H9	393	175	190

### S5 batteries with EFB technology

Bosch TTN	ETN	HKB	Power output	Technical details			Box size	Dimensions in mm			
				Ah	A(EN)	Circuit		Mount	L	B	
0 092 S5E 050	560 500 056	S5 E05	60	560	0	1	B13	H5	242	175	190
0 092 S5E 070	565 500 065	S5 E07	65	650	0	1	B13	T6	278	175	175
0 092 S5E 080	570 500 065	S5 E08	70	650	0	1	B13	H6	278	175	190
0 092 S5E 100	575 500 073	S5 E10	75	730	0	1	B13	T7	315	175	175
0 092 S5E 110	580 500 073	S5 E11	80	730	0	1	B13	H7	315	175	190

S5 batteries without EFB technology are not suitable for start/stop applications.

# Bosch: Bringing you the workshop of the future

For over 125 years, Bosch innovations have been keeping vehicles on the road and getting people to and from their destinations while improving safety and peace of mind along the way.

Bosch Automotive Aftermarket offers workshops and retailers a comprehensive portfolio of products that is unmatched worldwide:

- ▶ Efficient diagnostics
- ▶ Innovative workshop equipment
- ▶ Quick, reliable delivery
- ▶ The world's most comprehensive range of spare parts – including both new and remanufactured
- ▶ Workshop concepts to meet every requirement
- ▶ Comprehensive training
- ▶ Targeted sales and marketing support
- ▶ A competent service hotline
- ▶ 24-hour online workshop services
- ▶ Affordable leasing services for workshop equipment and software

From parts to scheduling, organization and results, our solutions are combined with additional services to ensure your needs will be perfectly met, helping you to maximize your potential.

## Workshop tip:

Bosch also delivers devices to teach batteries with EFB and AGM technology in the control unit, and a large number of modern battery chargers with different equipment.



Technical changes and program modifications are reserved

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## The world of Bosch:

- ▶ Diagnostics
- ▶ Diesel systems
- ▶ Gasoline systems
- ▶ Braking systems
- ▶ Spark plugs
- ▶ Energy systems
- ▶ Batteries
- ▶ Filters
- ▶ Wiper systems
- ▶ Lighting technology
- ▶ Comfort electronics
- ▶ Technical hotline
- ▶ Knowledge database
- ▶ Service training
- ▶ Workshop concepts

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