

NEW!

100% maintenance
free program



Bosch Batteries: **Optimal starting power** for all vehicles

The right Bosch battery for most vehicles.

☆☆☆ **S3:** The economical energy source for standard performance requirements

☆☆☆☆ **S4:** The powerful energy source for every vehicle

☆☆☆☆☆ **S5:** The premium energy source for high performance requirements



BOSCH

Invented for life

Contents

Page	
2	Contents
3	Nationwide warranty
4-5	Bosch battery types
6	S3 battery - features and benefits
7	S4 battery - features and benefits
8-9	S5 battery - features and benefits
10	Strong brand and recycling
11	Development of energy consumption of new cars
12-13	Technical data
14	Product interchange
15	Notes
16	1. Introduction
16	1.1 Safety warnings and standards
16	2. Battery recharging procedures
16	2.1 Battery charging indicators
16	2.2 Steps prior to charging
17	2.3 Recharging with a constant current
17	2.4 Recharging with a constant voltage
17	2.5 Actions during and after recharging
18	3. Battery usage and defects
18	3.1 Jump start
18	3.2 Battery installation and removal
19	3.3 Taking the vehicle out of service
19	3.4 Technical information on battery problems
19	3.4.1 Manufacturing defects
19	3.4.2 Mishandling and warranty exclusion
20	3.4.2 Mishandling and warranty exclusion
21	3.5 Checking for malfunction by load tester
21	4. Inspection, storage and stacking
21	4.1 Inspection on receipt of goods
22	4.2 Storage
22	4.3 Stacking
23	FAQs
24	FAQs
25	FAQs
26	FAQs
27	FAQs

Bosch Battery Program

Technical Information

Frequently Asked Questions

Nationwide **Warranty**

Bosch batteries are warranted to be of merchantable quality and fit for the purpose for which they have been designed and ordinarily used under normal use and service.

The warranty period commences on the date of purchase. Proof of purchase is required to process a warranty claim. The warranty period is as follows: Private vehicles - S3 24months, S4 36 months, S5 36 months; Truck/Commercial/Industrial/ 4x4 - 12 months; Taxis: 3 months.

The warranty is for replacement of the battery only and does not include any labour costs, consequential losses or other expenses. The warranty is void if a battery fails due to faulty installation, overcharging, deliberate abuse, neglect or incorrect use, negligence, alterations, accidents or failure to follow instructions.

The warranty is provided in addition to any conditions or warranties imposed or implied by any applicable law.

For further information, please contact your Bosch stockist.

www.bosch.com.au





Optimal **starting power** for all vehicles

The leaders in battery development

Bosch has been manufacturing batteries since 1927 when battery ignition for motor vehicles was first introduced. Since that time the demands on batteries have increased significantly with the introduction of features such as electric windows, air conditioning, ABS and airbags. With unmatched expertise in automotive electrical systems, Bosch has kept pace with these developments and now provides a range of batteries which meet the demands of modern vehicles.

Compact program, comprehensive coverage

The Bosch battery program offers comprehensive market coverage within a compact program. Three levels of performance are available, each colour coded to make selecting the right battery easy.

Bosch Battery S3

Maintenance free and provides economical and reliable power for standard vehicle applications.

Bosch Battery S4

A powerful maintenance free energy source with long service life and low self-discharge. Suitable for virtually all passenger vehicles.

Bosch Battery S5

Premium maintenance free battery for high performance. Includes Silver Alloy technology to ensure the highest level of starting power and longer service life.

Clear assignment of the Bosch battery types

	S3 ☆☆☆ Reliable performance	S4 ☆☆☆☆ Premium performance and value	S5 ☆☆☆☆☆ Maximum performance and extra long life
Product Features and Benefits	Factory sealed Maintenance Free Expanded grid Calcium Calcium technology provides Long Service Life	Factory sealed Maintenance Free High density expanded grid Calcium Calcium technology provides Longer Service Life	Factory sealed Maintenance Free Silver technology further resists heat and corrosion providing Extra Long Service Life
Nationwide Warranty for private use vehicles <small>Refer to details on page 3</small>	24 months	36 months	36 months
Suitable Applications	Standard vehicles	Standard vehicles with additional electronic devices eg. Driving lights, reverse sensors etc.	Modern vehicles with many electronic devices and 4WD's
			



Powerful start to every journey

Power windows and mirrors

Radio and instrument display

Powerful start to every journey

Electrical seat heating in rear

Cockpit and steering wheel electronics

Bosch Battery **S3: Economic** power. **Dependable** starting

The **Bosch Battery S3** is an economic solution, suitable for a wide range of passenger vehicles, trucks and other commercial vehicles with few energy consuming components. It provides dependable starting power and is maintenance free.

Advantages of the Bosch Battery S3

- ▶ Maintenance free
- ▶ High performance
- ▶ Long service life
- ▶ Good, reliable Bosch quality
- ▶ Best solution for conversion of conventional range
- ▶ Economic power supply
- ▶ Minimised self discharge rate
- ▶ Strong performance against corrosion

Quality and reliability

Bosch batteries are built to start in virtually any outside temperature. Their innovative grid technology also makes them resistant to high temperatures inside the engine chamber which often exceed 100°C. At the same time, acid consumption and corrosion are minimised. This translates into minimum self-discharge, tolerance for short-distance driving and perfect operational safety throughout their entire service life.



Bosch Battery **S4:** **Strong** power for every vehicle

Vehicles come in all shapes and sizes, each with varying electrical needs. The **Bosch Battery S4** meets the electrical demands of a wide range of vehicles, ensuring a dependable supply of power to keep the energy consuming components working properly at all times.

Advantages of the Bosch Battery S4

- ▶ Maintenance free
- ▶ 15% more cold-starting power
- ▶ 20% increased service life with innovative silver alloy
- ▶ Safely ensures the energy supply of medium convenience features in a vehicle
- ▶ Permanently meets the high requirements of international auto manufacturers regarding electrical values
- ▶ Suitable for most passenger vehicles



Bosch Battery **S5**: Premium energy for **highest performance**.

Are your customers looking for the highest starting power? Increased service life and safety? Then look no further than the **Bosch Battery S5**. Specifically designed with Silver Alloy Technology, the S5 surpasses international standards set by original equipment manufacturers. Even at extreme temperatures the S5 provides safe and powerful energy supply for highly sophisticated, energy consuming components.

Advantages of the Bosch Battery S5

- Maintenance-free
- Innovative Bosch Silver Technology
- 30 % more cold-starting power
- Safe starting also in extreme temperatures
- 30 % increased service life
- Fulfills and surpasses original equipment recommendations
- Dependable supply of power for vehicles with additional safety features such as ESP and ABS.
- Minimal self-discharge
- Extreme short-distance tolerance
- Maximum safety with:
 - Leak-proof, patented labyrinth cap
 - Double backfire protection



Electric seat settings



Display-supported setting for seat heating



On-board navigation



On-board tv





The new Bosch battery program

Strong Brand, Strong Power

Bosch technologies are continuously developed in close cooperation with car manufacturers. This ensures that Bosch remains at the cutting-edge of automotive technology, delivering products that meet the increasing demands of modern vehicles.

Bosch has specific expertise in engine management and electrical systems and has applied this knowledge in the development of the new battery program.

The Battery Recycling System of Bosch

Take your old battery back to your local Bosch battery stockist for disposal.



The Battery **Expertise** of Bosch: **Safety** and **Convenience** for Every Use

The Quality Battery Program of Bosch

The battery program of Bosch, the world's leading automotive supplier, has the right battery for most automotive applications, covering up to 90% of the market.

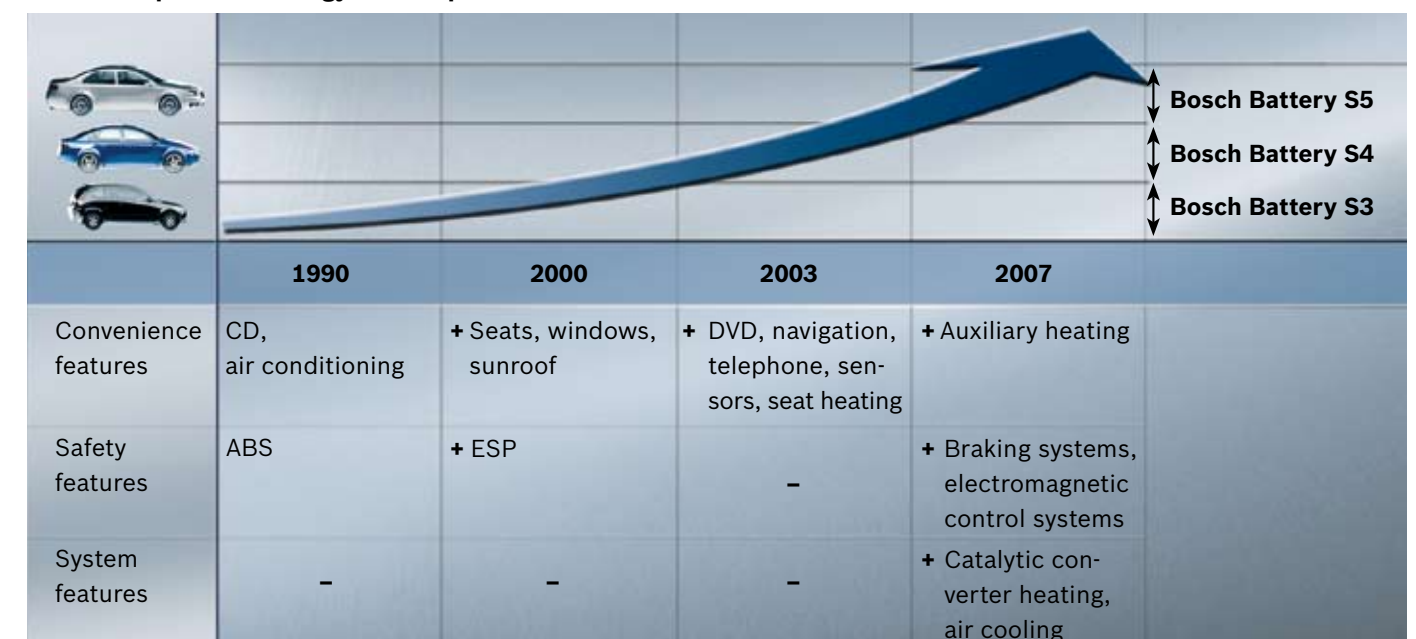
Smart Starting and More

With their extremely high capacity and cold-start currents, Bosch batteries provide reliable starting power in virtually any outside temperature. Their innovative grid technology makes these energy packs resistant to high temperatures in the engine chamber. At the same time, water consumption and corrosion are significantly reduced. This translates into minimum self-discharge, extreme tolerance for short-distance driving and perfect operational safety throughout their entire service life.

Longer Service Life

Today's enclosed engines are really putting the heat on car batteries. Whereas 20 years ago, temperatures in the engine chamber wouldn't climb above 50°C, today they often exceed 100°C. The employment of Bosch Silver Technology considerably reduces corrosion caused by heat, significantly increasing the service life of batteries.

The development of energy consumption of new cars



Bosch batteries are designed to handle the increasing energy demands of modern vehicles.

Technical Data

Bosch Part Number	20Ah Rate	RC	CCA	CCA Norm	Length (mm)	Width (mm)	Total Height (mm)	Gross Wt (Kg)	Terminal	Terminal Layout	Bottom Hold Down	Terminal Layout
S3												
54316	43	70	420	SAE	211	175	175	12.3	STD	(- +)	B3/B4	A
55457	54	90	500	SAE	245	175	175	14.10	STD	(- +)	B3	A
55458	54	90	500	SAE	245	175	175	14.10	STD	(+ -)	B3	B
56318	63	110	580	SAE	277	175	175	16.50	STD	(- +)	B3/B4	A
56638	66	110	580	SAE	278	175	190	16.80	STD	(- +)	B3	A
56640	66	110	580	SAE	278	175	190	16.80	STD	(+ -)	B3	B
58513	85	140	740	SAE	303	173	225	21.50	STD	(- +)	B0	A
58515	85	140	740	SAE	353	175	175	21.8	STD	(- +)	B3	A
115F51	120	230	900	SAE	505	183	240	33.00	STD	(+ -)	B0	D
145G51	150	300	1000	SAE	508	222	241	39.00	STD	(+ -)	B0	D
190H52	200	430	1150	SAE	523	279	248	55.00	STD	(+ -)	B0	D
22F-530	56	95	530	BCI	240	174	205	15.0	STD	(- +)	B9	A
22F-530DF	56	95	530	BCI	240	174	211	15.0	DF	(- +)	B9	A
22FR-530	56	95	530	BCI	240	174	205	15.0	STD	(+ -)	B9	B
31-930	112	190	930	BCI	330	173	240	26.00	STUD/STD	CENTRE	B0	B
40B19L	35	49	300	SAE	187	127	226	10.00	SMALL	(- +)	B0	A
40B19LS	35	49	300	SAE	187	127	226	10.00	STD	(- +)	B0	A
40B19R	35	49	300	SAE	187	127	226	10.00	SMALL	(+ -)	B0	B
40B19RS	35	49	300	SAE	187	127	226	10.00	STD	(+ -)	B0	B
55B24L	45	80	430	SAE	238	129	225	12.50	SMALL	(- +)	B0	A
55B24LS	45	80	430	SAE	238	129	225	12.50	STD	(- +)	B0	A
55B24R	45	80	430	SAE	238	129	225	12.50	SMALL	(+ -)	B0	B
55B24RS	45	80	430	SAE	238	129	225	12.50	STD	(+ -)	B0	B
55D23L	60	100	500	SAE	232	173	225	15.80	STD	(- +)	B0	A
55D23R	60	100	500	SAE	232	173	225	15.80	STD	(+ -)	B0	B
55D26L	60	100	500	SAE	260	173	222	16.00	STD	(- +)	B0	A
55D26R	60	100	500	SAE	260	173	222	16.00	STD	(+ -)	B0	B
75D31L	75	120	630	SAE	303	173	225	21.00	STD	(- +)	B0	A
75D31R	75	120	630	SAE	303	173	225	21.00	STD	(+ -)	B0	B
95D31L	90	145	730	SAE	303	173	225	22.00	STD	(- +)	B0	A
95D31R	90	145	730	SAE	303	173	225	22.00	STD	(+ -)	B0	B
95E41	100	180	830	SAE	410	175	235	25.50	STD	(+ -)	B0	B
AU22-530DF	56	95	530	BCI	231	169	211	15.0	DF	(- +)	B0	A
AU22R-530	56	95	530	BCI	231	169	205	15.0	STD	(+ -)	B0	B
U1-230	23	30	230	BCI	197	136	186	7.00	LUG	(+ -)	B0	B
U1R-230	23	30	230	BCI	197	136	186	7.00	LUG	(- +)	B0	A
S4												
105D31L	90	160	710	BCI	305	172	225	22.45	STD	(- +)	B7	A
105D31R	90	160	710	BCI	305	172	225	22.45	STD	(+ -)	B7	B
130E41R	110	190	700	BCI	406	172	231	29.2	STD	(+ -)	B0	B
150F51	135	245	1005	BCI	503	182	231	35.4	STD	(- +)	B0	A
165G51	150	300	1050	BCI	507	213	231	42.6	STD	(- +)	B0	A
22F-610	55	90	610	BCI	240	172	205	15.2	STD	(- +)	B9	A
22F-610FD	55	90	610	BCI	240	172	209	15.3	DF	(- +)	B9	A
22FR-610	55	90	610	BCI	240	172	205	15.2	STD	(+ -)	B9	B
22NF-330D	40	60	330	BCI	238	134	204	11.2	DF	CENTRE	B9	G
31-901	100	160	900	BCI	330	173	239	25	STD	CENTRE	B0	G
42B19LS	38	52	340	BCI	186	129	227	10	STD	(- +)	B0	A
42B19RS	38	52	340	BCI	186	129	227	10	STD	(+ -)	B0	B

Technical Data

Bosch Part Number	20Ah Rate	RC	CCA	CCA Norm	Length (mm)	Width (mm)	Total Height (mm)	Gross Wt (Kg)	Terminal	Terminal Layout	Bottom Hold Down	Terminal Layout
S4 (cont.)												
80D23L	70	120	560	BCI	229	172	225	16.7	STD	(- +)	B7	A
80D23R	70	120	560	BCI	229	172	225	16.7	STD	(+ -)	B7	B
90D26L	75	140	620	BCI	260	172	225	18.8	STD	(- +)	B7	A
90D26R	75	140	620	BCI	260	172	225	18.8	STD	(+ -)	B7	B
DC24	70	120	500	BCI	275	172	229	20.3	MRN	(+ -)	B7	B
DC27	80	145	570	BCI	320	172	229	23.7	MRN	(+ -)	B7	B
DC31	100	180	625	BCI	330	172	234	27	MRN	CENTRE	B0	G
M24	65	115	490	BCI	275	172	229	19.3	MRN	(+ -)	B7	B
M27	105	160	570	BCI	320	172	229	24.26	MRN	(+ -)	B7	B
M31	100	180	625	BCI	330	172	234	26.5	MRN	CENTRE	B0	G
N200(L) (8D-1300)	210	440	1300	BCI	510	275	238	57.5	STD	(- +)	B0	D
N200(R) (8D-1300)	210	440	1300	BCI	510	275	238	57.5	STD	(+ -)	B0	E
U1-260	26	33	260	JIS	196	126	184	7.8	LUG	(- +)	B0	A
U1R-260	26	33	260	JIS	196	126	184	7.8	LUG	(+ -)	B0	B
S5												
22F-680	60	105	680	BCI	240	172	205	15.2	STD	(- +)	B9	A
22FR-680	60	105	680	BCI	240	172	205	15.2	STD	(+ -)	B9	B
90D23L	75	125	650	BCI	229	172	225	17.3	STD	(- +)	B7	A
90D23R	75	125	650	BCI	229	172	225	17.3	STD	(+ -)	B7	B
110D26L	90	160	680	BCI	260	172	225	20.7	STD	(- +)	B7	A
110D26R	90	160	680	BCI	260	172	225	20.7	STD	(+ -)	B7	B
125D31L	92	165	760	BCI	305	172	225	22.3	STD	(- +)	B7	A
125D31R	92	165	760	BCI	305	172	225	22.3	STD	(+ -)	B7	B

Abbreviations

- B0

No bottom hold down
- B1

2 bottom hold-downs 10.5mm high on long sides
- B3

4 bottom hold-downs 10.5mm high on all four sides
- B4

2 bottom hold-downs 19mm high on long sides
- B3/B4

B4 BHD available with adaptor on long sides
- B7

2 bottom hold-downs 9.7mm high on long sides
- B9

4 bottom hold-downs 10.5mm high on long sides, 29mm on short sides
- BN

Bolt nut terminal
- DF

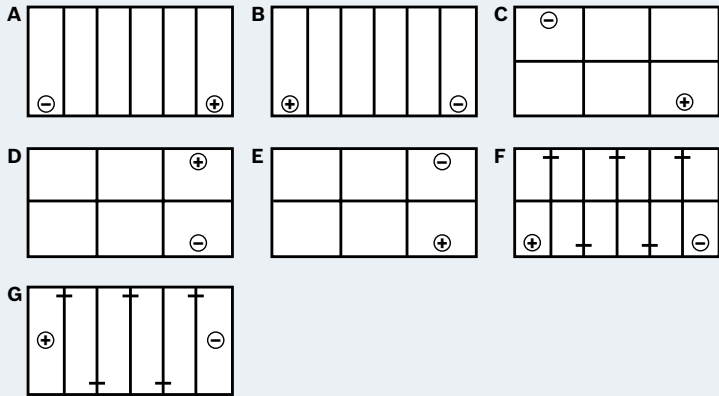
Dual fit terminal
- SM

Small terminal
- STD

Standard terminal
- TM

Twin marine

Assembly Layout



Product Interchange

Competitor Part Number	Bosch Replacement
22F530SMF	22F-530
22F530SMFDF	22F-530DF
22F600SMFDF	22F-610FD
22FR530SMF	22FR-530
22FR600SMF	22FR-610
41	22NF-330D
43	22NF-330D
46	22NF-330D
47	22NF-330D
51	22NF-330D
53	22NF-330D
55D23L	55D23L
55D23R	55D23R
57	22FR-530
57EF	AU22R-530
58	22F-530DF
58EB	AU22-530DF
58VT	22F-530
67	22FR-610
68	22F-610FD
68VT	22F-610
AU22530SMFDF	AU22-530DF
AU22R530SMF	AU22R-530
DIN44	54316
DIN44LMF	54316
DIN53L	55457
DIN53LMF	55457
DIN53RMF	55458
DIN65L	56318
DIN65LMF	56318
DIN65RMF	56640
DIN85L	58515
DIN92LMF	58515

Competitor Part Number	Bosch Replacement
MF40B20DF	40B19R
MF40B20L	40B19L
MF43	22NF-330D
MF50	22FR-610
MF50	22FR-530
MF52	22F-610FD
MF52	AU22-530DF
MF52	22F-530DF
MF53	22F-610
MF53	22F-530
MF54	AU22R-530
MF55B24LS	55B24LS
MF55B24RS	55B24RS
MF75D23L	80D23L
MF75D23R	80D23R
MF80D26L	90D26L
MF80D26R	90D26R
MF95D31L	95D31L
MF95D31R	95D31R
N70ZZ	75D31R
N70ZZ4WD	95D31R
N70ZZH	95D31R
N70ZZL	75D31L
N70ZZL4WD	95D31L
N70ZZLH	95D31L
NS40Z	40B19R
N70ZZX	75D31R
N70ZZLX	75D31L
NS40ZL	40B19L
NS40ZLS	40B19LS
NS40ZLSX	42B19LS
NS40ZS	40B19RS
NS40ZSX	42B19RS

Competitor Part Number	Bosch Replacement
NS60LS	55B24LS
NS60RS	55B24RS
NS60S	55B24RS
NS70	55D26R
NS70L	55D26L
NS70LX	90D26L
NS70X	90D26R
S40B20L	40B19L
S40B20LS	40B19LS
S40B20R	40B19R
S40B20RS	40B19RS
S54316	54316
S55457	55457
S55458	55458
S55B24LS	55B24LS
S55B24RS	55B24RS
S55D23L	55D23L
S55D23R	55D23R
S55D26L	55D26L
S55D26R	55D26R
S56318	56318
S56638	56638
S56640	56640
S58515	58515
S70D23L	80D23L
S70D23R	80D23R
S75D31L	75D31L
S75D31R	75D31R
S80D26L	90D26L
S80D26R	90D26R
S85B60L	22F-610
S95D31LHD	95D31L
S95D31RHD	95D31R

Whilst every care has been taken in the preparation of this publication Bosch cannot guarantee the accuracy of the information. Bosch does not therefore warrant the accuracy or completeness of the information contained herein. Further, Bosch reserves the right to alter specifications and its product range without notice. To the extent permitted by law, Bosch excludes all liability including negligence for any loss incurred in reliance on the contents of this publication. From time to time, Bosch may (in its discretion) issue bulletins containing updates to this information to which users of this publication should have regard.

Notes




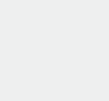


[illegible]





Technical Information

1. Introduction

This manual provides essential information on the operation, characteristics, design, handling and charging of lead-acid batteries as well as the correct procedures for using, stocking and maintaining batteries for road vehicles, in addition to providing information on the main areas of care needed to be taken for the safety of staff who work with Bosch batteries, so as to get the most from our products and for customer satisfaction.

1.1 Safety Warnings and Standards

	Observe the information on the battery, the battery's operating manual and the vehicle's operating manual.
	Wear eye protection as a precautionary measure when working on the battery.
	Keep acid and filled batteries out of reach of children. Keep out of reach of children when working on the battery.
	Fire, sparks, naked flames and smoking are prohibited: <ul style="list-style-type: none">▶ Avoid creating sparks when handling cables and electrical equipment as well as those caused by electrostatic discharge.▶ Avoid short-circuits. Never connect the positive terminal to the negative terminal of the same battery because it will cause a short circuit. A short circuit can cause burns, fire or the explosion of the battery.▶ Clean with damp cloth only and wear appropriate clothing. Dry cleaning cloth might become electrically charged and produce sparks.
	Danger of explosion: <ul style="list-style-type: none">▶ An explosive oxyhydrogen gas mixture is formed when batteries are charged. Explosive gases can cause blindness and injury.
	Corrosive hazard: <ul style="list-style-type: none">▶ Battery acid is extremely corrosive. The acid can cause burns and blindness. Under normal operation conditions, there should be no contact with the electrolyte (diluted sulphuric acid). Please note that when the battery casing of a battery with fixed electrolyte is destroyed or damaged, bound electrolyte in glass fibre mats or jellified electrolyte is as corrosive as when liquid.▶ Wear protective gloves and goggles.▶ Do not tilt the battery permitting acid to leak out of vent openings.

	First aid: <ul style="list-style-type: none">▶ Drops of acid coming into contact with eyes should be rinsed for several minutes using clear water. Then consult a doctor without delay.▶ Drops of acid on the skin or clothes should be neutralized immediately using acid neutralizer or soap suds and rinsed with plenty of water.▶ If acid is swallowed, drink plenty of water and consult a doctor immediately.
	Warning: <ul style="list-style-type: none">▶ The enclosure becomes brittle with time, therefore: Do not expose batteries to direct sunlight.▶ Discharged batteries can freeze so store in a place where they are protected from frost.▶ It is dangerous to use tools such as hammers on the battery terminal when connecting cables.▶ Never rub with dry cloth on the battery casing. This might produce sparks because of electrostatic discharges and can cause an explosion.
	Disposal: <ul style="list-style-type: none">▶ Dispose old batteries at a battery collection point.▶ Never dispose old batteries as household waste.▶ If a battery with glass fibre materials is destroyed or damaged, the released fibre material must be disposed in line with the official local regulations.▶ Do not let electrolyte penetrate into the sewage system, the soil or into groundwater.
	Corrosive hazard: <ul style="list-style-type: none">▶ The item is hazardous according to the criteria of Work Safe Australia.

2. Battery Recharging Procedures

2.1 Battery Charging Indicators

Charging of the battery is required when the:

- ▶ Storage period is more than 6 months without charging.
- ▶ Colour of state of charge (SOC) indicator turns black.
- ▶ Battery operating current voltage (OCV) is less than 12.4V.

2.2 Steps Prior to Charging

- ▶ Wear protective glasses whilst handling the battery.
- ▶ Do not carry out charging near fire or spark.
- ▶ Do not charge damaged or frozen battery.
- ▶ Boost charge is not recommended.
- ▶ If the battery has accessible screw-in plugs, check the electrolyte level in each cell and top up with distilled water if necessary.

Technical Information

- ▶ Do not switch on the charger until battery has been connected. Do not switch off the charger until charging is complete.
- ▶ Position the batteries so that there is a space of at least 20mm between them.
- ▶ Only use batteries with the same capacity and same state of charge in the same circuit. This prevents the slightly discharged batteries from being overcharged when connected to the same circuit as a battery that needs a longer time to recharge.
- ▶ Batteries must always be connected in series, that is, the positive pole of a battery should be connected to the negative pole of the neighbouring battery, thus the positive pole of the first battery and the negative pole of the last battery will always be open.
- ▶ All of the batteries for recharging should have their density and/or open voltage checked, so that the batteries could be grouped (based on state of charge) for the purpose of placing them in the right circuit for the recharging process.

Warning: Never connect the positive pole to the negative pole of the same battery or in the same series, as this will cause a short circuit.

Check that the connections (lugs) make good contact by twisting them slightly while pressing them onto the pole.

2.3 Recharging with a Constant Current

When recharging the battery with a constant current, the voltage will increase slowly during the recharging. Towards the end, the voltage increases rapidly and the process should be stopped at the voltage value limit.

Example: 45Ah battery.

Recharging Current: $45 \times 0.1 = 4.5\text{A}$ (10% of the nominal capacity of the battery).

The recharging time depends on the state of charge of the battery.

OCV in stable condition	State of charge	Battery capacity (20Ah)					
		35-40	41-50	51-65	66-75	76-90	91-110
12.5 - 12.59	70%	3X4	4X4	5X4	6X4	6X5	7X5
12.4 - 12.49	60%	3X6	4X6	5X6	6X6	6X7	7X7
12.3 - 12.39	50%	3X8	4X8	5X8	6X8	6X9	7X10
12.2 - 12.29	40%	3X10	4X10	5X10	6X10	6X12	7X12
12.1 - 12.19	30%	3X13	4X12	5X12	6X12	6X14	7X15
Below 12.09	20%	3X15	4X14	5X14	6X14	6X16	7X17

Warning: The battery temperature must not exceed 50°C during the recharging process.

Note:

- ▶ The above table shows approximate Ah and charging hours needed for recharging according to the battery capacity and the OCV under a constant current charging method. Accordingly, the Ah or the charging hours may be adjusted depending on the type and the state of the charged battery.
- ▶ Always charge the battery according to the amount of charge needed. Prolonged charging times, especially with a constant current, could cause the battery to become overcharged, causing an unnecessary loss of water in the process.
- ▶ Avoid quick charges that are done without controlling the temperature, current or time.
- ▶ Some batteries below 12.1V can be hard to re-charge due to the long time elapsed since the last re-charge. It is very difficult to recover its original performance.

2.4 Recharging with a Constant Voltage

When using this charging method, the initial current applied to the battery should be limited to 25A and the voltage to 14.4V.

The battery charging time will vary according to its state of charge, as shown in the table below:

Battery voltage when empty (volts)	Recharging Time (hours)
12.00 to 12.20	6 to 12
11.80 to 11.99	10 to 16
11.50 to 11.79	16 to 20
11.00 to 11.49	20 to 24
Deeply discharged batteries	24 to 30

Warning: the battery temperature must not exceed 50°C during the recharging process.

2.5 Actions During and After Recharging

▶ Electrolyte Temperature

The electrolyte temperature, hence the battery container temperature must not exceed 50°C.

The recharging process should be stopped if this temperature is exceeded.

The process may be resumed once all batteries in the recharging circuit reach 45°C or less.

▶ Recharging Time

We recommend waiting approximately 20 minutes to allow gases to dissipate before removing the leads from the batteries, as some chargers remain in a charged state and can generate sparks. Replace the vent caps and gas tubes if they were removed. Wash the battery using warm water and dry it.

3. Battery Usage and Defects

3.1 Jump Start

When performing a jump start using jumper cables, there can be bursts of high voltage of hundreds of volts when connecting the cables. If the vehicle's electrical system is not protected against such surges, they can cause damage to sensitive electronic components, like the ABS system, the airbags control units, etc.

Please follow the vehicle manufacturer's operating instructions!

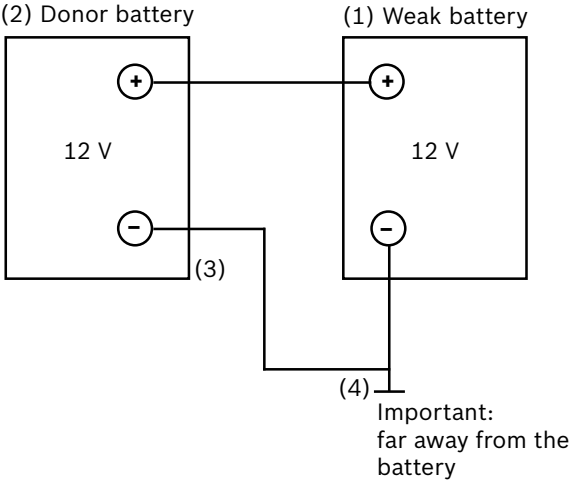
- ▶ Do not attempt to jump start a damaged battery.
- ▶ When giving starting aid with jumper cables, high voltage peaks of several hundred volts can occur when connecting the cables. If the vehicle electrical system is not protected from these peaks, they can damage sensitive electronic components.
- ▶ Only use standardised battery jumper cables. Only connect batteries of the same nominal voltage.
- ▶ Before giving starting aid, try to figure out the reason for the battery weakness. If the reason is a failure in the vehicle electrical system, starting aid should not be given. The battery or the electric system of the vehicle giving starting aid might become damaged.
- ▶ Warning: Always protect your eyes and hands from the battery.

How to do it: 4 easy steps

1. Turn off both vehicle engines.
2. Connect the positive terminals (1) and (2) and then connect the charged battery's negative terminal (3) with a bare metallic point (4) away from the battery of the vehicle requiring assistance.
3. Start the engine in the vehicle providing assistance, followed by the engine in the vehicle requiring assistance for a maximum of 15 seconds.
4. Disconnect the cables in reverse order (4-3-2-1).

Use only standard jumper cables for connecting the batteries. Connect only batteries with the same nominal voltage.

Before performing a jump start, try to find out what caused the battery failure. If the cause was a fault in the electrical system, do not jump start. The battery or the electrical system of the vehicle providing the jump start could be damaged.



3.2 Battery Installation and Removal

Modern vehicles are equipped with sensitive electrical systems such as airbag controllers, ABS, stability and traction control units, onboard computers etc. For some vehicles, it is necessary to follow certain procedures in order to install or take the battery out of service. For example, the electrical components may require resetting after they have been turned off.

Please follow the vehicle manufacturer's operating instructions!

1. Switch off the engine and all electrical equipment before installing or removing the battery.
2. Install only batteries that are fully charged and undamaged.
3. Install the type of battery recommended for the particular vehicle.
4. Avoid causing short-circuits with tools or cables. After having installed the battery in the vehicle, remove the covers from the terminal poles just before connecting the cables to the terminals.
5. For removing, disconnect the negative terminal (-) first and then the positive terminal (+). Before installing the battery, clean the surface inside the vehicle. Fix the battery safely and securely. If the battery is not securely installed, it will be subjected to a larger degree of vibration which can reduce its service life. Friction between the battery container and the support area can cause damage and wear to the container. Also, the container can rupture, causing the electrolyte to leak out.
6. Clean the battery terminals and its lugs. Lubricate them lightly with acid-free grease. When installing, connect the positive terminal (+) first, then the negative terminal (-). Check that the terminal lugs are firmly in place. Make use of the accessories from the previous battery such as hose connections, terminal supports and covers for terminals. Use the top-up caps supplied.

7. At least one vent must remain open to avoid the risk of an explosion.

3.3 Taking the Vehicle out of Service

When a vehicle is taken out of service (for example, when it is used only seasonally), charge up the battery and store it in a cool place. If it is necessary to leave the battery in the vehicle, disconnect the negative terminal. Check the OCV of the battery every two months. If the OCV is below 12.4V, recharge the battery.

3.4 Technical Information on Battery Problems

3.4.1 Manufacturing Defects

Short Circuit / Dead Cell

If a battery has a service life that is less than 12 months, the problem is usually caused by a dead cell, that is, one of the cells has a density value that is much lower than the others. The affected cell bubbles visibly during the high-discharge test. To evaluate the density, a high-discharge test should be carried out. In some cases, the dead cell may be visible in the form of a sulphated cell.

Internal Breakage

The battery has good density values, but the voltage across the terminals cannot be measured.

3.4.2 Mishandling and Warranty Exclusion

The following technical problems are caused by mishandling the battery. Such cases are not subject to warranty.

Low State of Charge

A low state of charge is the first stage of deep discharge. With a low state of charge, the active material will not have sustained any damage. The battery can still be charged with a standard charger.

The causes of a low state of charge are:

- ▶ A defective alternator.
- ▶ A low voltage output from the regulator.
- ▶ High contact resistances caused by loose cable connections or dirt on the cable terminals.
- ▶ Slack drive belts.
- ▶ Insufficient engine running time due to short journey times.
- ▶ Subsequent addition of electrical equipment.
- ▶ Defective equipment causing continuous discharge.

Deep Discharge

A battery suffers a deep discharge when its capacity is totally used up. The longer the battery remains in this state, the greater will be the damage done to the active material. The plates begin to suffer sulphation and recharging becomes impossible. This damage is irreversible.

Possible causes of deep discharge are:

- ▶ See 'Causes of Low State of Charge'
- ▶ Headlights or other electrical equipment are not switched off.

A battery in a good state of charge will usually have a load-free voltage >12.6V. Therefore, the voltage without charge for each cell is about 2.1V. If there is a short circuit in just a single cell, this will result in a reduction of about 2.1V of the terminal voltage, which would be a typical 'short-circuit' voltage of 10.5V. The likelihood of two cells within the same battery having a short circuit is very low. In the case of two cells with short circuits, the OCV drops by 4.2V to a value of 8.4V. In order to exclude the effects of long shipment and storage times on the terminal voltage, as well as the possibility of two cells with short circuits etc., only batteries with a load-free voltage lower than 8 volts are regarded as deeply discharged and a claim on warranty will be rejected.

Sulphation

If a battery is left in a discharged state for an excessive period of time, there will be a chemical reaction known as sulphation, which will certainly compromise its performance. During the discharge process, lead sulphate is generated on the positive and negative plates and distributed evenly among them.

The longer the battery is left in a discharged state, the more the small sulphate crystals grow into larger crystals and it becomes very difficult to convert these back into lead dioxide. Sulphation can become visible in the form of a white/grey layer on the plates. In most cases, this damage is irreversible and the battery cannot be used anymore.

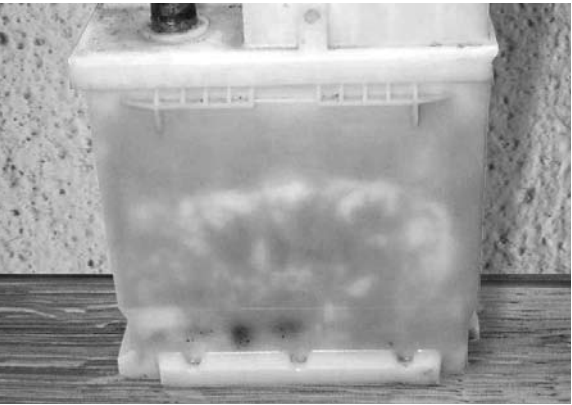


Figure 1 – Picture of a battery with deep discharge and sulphation

Technical Information

Sulphation can either occur during storage or if the battery is installed in a vehicle (or equipment) that is not used for a long period of time. While in a vehicle, the battery is constantly drained by the clock, the alarm system, etc., resulting in a decrease in the level of charge of the battery and, after a certain period of time, sulphation of the plates. However, even a disconnected battery undergoes sulphation due to self-discharge.

The causes of sulphation can be summed up as follows:

- ▶ There is an excessive lapse of time between one recharging and the next.
- ▶ An engine starter battery is used for “deep cycles”. This type of battery is not resistant to deep discharges.
- ▶ The battery is undercharged or the charging and adjustment of levels is carried out incorrectly.
- ▶ Low electrolyte level: a battery plate exposed to air starts to experience sulphation immediately.

Sulphation (lead sulphate) impedes the chemical reaction between the acid (electrolyte) and the active material (made up of lead) on the plates and it prevents normal operation of the battery. Even after recharging, the voltage will be low (< 12.4V), but, usually the cells will show equal values. Sulphation is not a manufacturing defect.

Acid Stratification

Acid stratification is a common cause of battery failure. In a stratified battery, the electrolyte is concentrated at the bottom and the top half of the cell has very little acid. Stratification takes place when the battery is kept with low charge (below 80%) and is never fully recharged. Short journeys that include the use of the windscreen wipers and electric heaters contribute to this phenomenon. Acid stratification reduces the general performance of the battery.

Figure 2 shows a normal battery in which the acid is distributed evenly from top to bottom. This battery has good performance because the correct concentration of acid is distributed evenly over the plates. Figure 3 shows a stratified battery in which the acid concentration is light at the top and heavy at the bottom. A light acid limits the plate activation, speeds up corrosion and reduces the performance. On the other hand, high acid concentration at the bottom artificially increases the open circuit voltage. The battery seems to be fully charged, but it delivers low starting power. High acid concentration also results in sulphation and further reduces the already low conductivity. If this condition goes undetected, it will ultimately result in battery failure.



Figure 2 – Without acid stratification

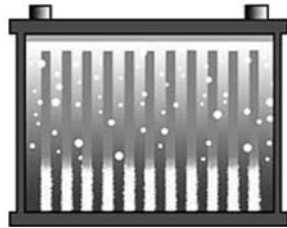


Figure 3 – With acid stratification

Fully recharging or shaking the battery tends to correct the problem.

Overcharging

Overcharging is often caused by an unsuitably high temperature in the engine compartment. Other than this, a defective voltage regulator is often another cause of overcharging. A high level of corrosion, loose particles of positive active material, damaged active material and high water consumption are characteristics of overcharging. A low level of electrolyte and a black layer on the filler caps are usually evidence for an overcharged battery. Excessive water consumption leads to an increase in electrolyte density. Also, a high temperature results in a lower internal battery resistance, causing an increase in the charge current and this increases the effect of overcharging.

Physical Damage

The battery container and the terminals will suffer obvious damage if the battery is installed incorrectly, if the cables are wrongly connected or if the cables are hammered incorrectly into the terminals.

In addition, if the terminal poles are melted, this indicates that the battery has had a short circuit. (Figure 4.1 and Figure 4.2)



Figure 4.1 – Picture of a melted battery terminal

Technical Information



Figure 4.2 – Picture of a melted battery terminal

Incorrect Application

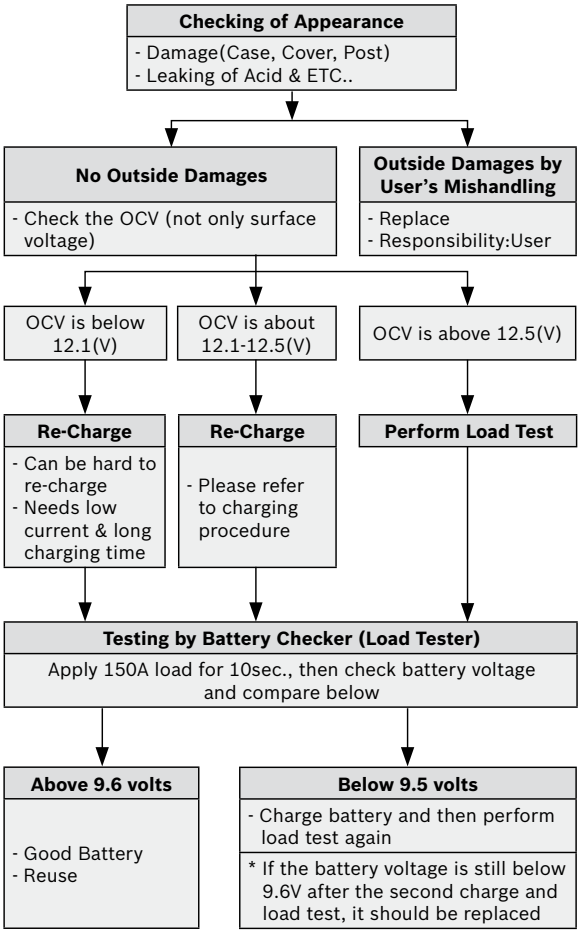
Batteries recommended by Bosch match or exceed the original equipment specifications. Choosing a battery of lower capacity or power will result in a shorter service life and premature battery failure. Usually, the result is a low charge level together with the effects described above.

Wear and Tear

During the charging and discharging cycle, the battery plate material (active material) moves about due to the electrochemical processes occurring. Every time that the battery undergoes a charging or discharging cycle, a small amount of active material comes loose from the plates. This normal aging process, caused by the charging and discharging cycles, results in a loss of battery capacity and, ultimately, the loss of its capacity to start the vehicle or power its equipment.

A battery has a finite number of cycles that it undergoes before losing its capacity. Vehicles that do a large number of short journeys, such as taxis, mini-cabs, trucks and buses, reach the maximum number of cycles in a shorter time than vehicles that do longer journeys. As a result, the batteries used in these types of vehicles may exhibit the above mentioned symptoms earlier than expected.

3.5 Checking for Malfunction by Load Tester



4. Inspection, Storage and Stacking

4.1 Inspection on Receipt of Goods

Before unloading the consignment of batteries, please check the details on the invoice against the goods delivered and your order details.

Check:

- ▶ The battery type.
 - ▶ The quantities.
 - ▶ Damaged batteries, batteries that were not transported in a horizontal position or those with leakage of electrolyte, should be rejected and sent back to the supplier, at the carrier's expense.
- After unloading and before stocking the batteries, check:
- ▶ The age of the battery, calculating this from its date of manufacture.
 - ▶ The open circuit voltage.
 - ▶ Do a visual inspection (container, cover, terminals, charge indicator, colours, and labels).

Technical Information

4.2 Storage

The batteries should be stored in a horizontal position on wooden pallets or racks (not tilted). Do not place them directly onto the ground, because small stones or sharp edges on the concrete floor can damage the battery container and cause leaks.

Batteries should be stored in a dry place and must not be exposed to direct sunlight. The storage temperature should be between 10°C and 35°C. Storage temperatures that are higher than this will result in greater water consumption, corrosion and self-discharge. The storage temperature must not exceed 35°C. The maximum period for storing decreases when batteries are stored at high temperatures.

4.3 Stacking

In order to avoid scratches and damage of labels, do not store unpackaged batteries on top of the other.

Always ensure that the instructions for stacking batteries are followed. Batteries up to 75Ah may be stacked in up to 5 tiers; batteries above 90Ah in up to 3 tiers and batteries above 150Ah in a maximum of 2 tiers. Do not remove the plastic shrink-wrapping. Use cardboard or polystyrene as an additional layer between the batteries.

Do not stack batteries with their terminal poles protruding without taking special measures to protect these terminals and to ensure that the stack is stable.

Follow the First in / First out (FiFo) procedure strictly. Following the FiFo procedure means that the first battery stored in stock is also the first battery to leave.

Non-compliance with the FiFo principle is the biggest cause of excessive storage!

FAQs

1 What is the difference between a cell and a battery?

The smallest electrochemical unit of a battery is called a cell. The cell does not have a complete container or contacts ready for use and is usually connected to neighbouring battery cells by means of soldered contacts.

Unlike a cell, it is easy to recognize a battery by its completed container that is equipped with contacts that are ready for use. Additionally, the container bears the manufacturer’s name clearly printed on it, the name of the type, the battery voltage, etc.

2 How is the battery constructed?

A 12V starter battery contains six individually separated cells that are connected in series in a polypropylene container. Each cell contains an element (cell package) that is made up of a set of positive and negative plates. In turn, these sets comprise lead plates (lead grid and active material) and micro-porous insulation material (separators) between the plates with opposite polarities. The electrolyte is diluted sulphuric acid. It permeates the pores of the plates and the separators and fills up the voids in the cells. The terminals, the cell connectors and the plate connections are all made of lead. A thermal sealing process is used to permanently bond the battery to its container, providing a superior quality seal for the battery.

3 What is the electrolyte?

The electrolyte is diluted sulphuric acid that permeates the pores of the plates and separators. It fills up the voids in the cells. The sulphuric acid component is responsible for turning pure water conductive so that it can be used as electrolyte.

4 What happens when a battery becomes discharged?

If a device (for example, a lamp) is connected to the terminals of a lead-acid battery, the difference in power between the poles results in a flow of electrons leaving the negative pole and flowing through the device and on to the positive pole.

This flow of electrons transforms the lead dioxide on the positive plate and the spongy lead on the negative plate into lead sulphate. This chemical process consumes the sulphuric acid and yields water. The specific gravity of the electrolyte is thus decreased and it is because of this that the state of charge of the battery can be determined, by measuring the specific gravity of the electrolyte.

5 What happens when a battery is charged?

When a battery is being charged, the flow of electrons and the chemical processes that occur during discharge are reversed. The result of the charging process is that the lead sulphate that is formed during the discharge process is once again converted into lead dioxide, lead and sulphuric acid and this restores the necessary chemical energy that will be converted into electrical power during future use.

An optimum charge voltage is important for charging a battery. If the voltage is too high, the water will be electrolysed. This reduces the electrolyte level over a period of time. If the voltage is too low, the battery cannot be adequately charged and this can also reduce its service life.

6 What are the consequences of a short circuit in the battery?

An external short circuit can occur if the battery terminals are connected by any type of conductive material. Depending on the battery system, a short circuit can have serious consequences. Lead-acid batteries are very powerful and a short circuit can cause burns, fires or an explosion of the battery.

Never connect the positive pole of the battery to its negative pole. When installing the battery, or when attaching the connecting cables to the battery poles, take all necessary measures to avoid short-circuits caused by tools or other conductive materials.

7 What does the abbreviation OCV mean and what does it tell me concerning the battery?

OCV stands for Open Circuit Voltage – the voltage in an open circuit. Other common terms are ‘off-load voltage’ or ‘voltage without load’. As the name indicates, OCV is the voltage measured between the two poles of the battery when the battery is not under load (no current consumption).

The OCV changes on completion of the charging or discharging process due to the effects of polarization and diffusion. The battery should be set aside, in a state of rest, sometimes up to a few days, until it reaches a stable state. If the OCV is measured shortly after a charging or discharging process, it will not be possible to obtain a correct value for the state of charge.

8 What is meant by battery capacity?

The capacity is the amount of electrical power that a battery can deliver under specific conditions. It is the product of the current and the time (ampere-hour, Ah).

The capacity is not a fixed parameter, but depends, among other things, on the following factors:

FAQs

- The level of the discharge current (the larger the discharge current, the smaller the capacity that can be used).
- The discharge process according to time (the capacity will be greater if there is a pause during the discharge than if the discharge process is continuous).
- The age of the battery (due to the loss of active material from the plates, the Ah capacity decreases when the battery is coming to the end of its service life).

9 What does cold start performance mean?

For a car battery used to supply electrical power to the starter motor, the starting capacity at low temperatures is usually more important than the Ah capacity. Cold start performance is defined according to different norms in different countries. Its value is indicated in amperes.

For example, according to the SAE J537 Norm, cold start performance is the maximum amount of current that a battery can produce for 30 seconds at -18°C without falling to 7.2V or below.

10 What does self-discharge mean?

Even if no consumption device is connected to the battery, “it is drained” electrically after a certain period of time since the electrochemical processes cannot be stopped or avoided, as they are part of any battery technology. This is not a phenomenon that is limited only to lead-acid batteries.

The self-discharge rate increases at higher temperatures. Therefore, batteries should be stored in a place with a low temperature.

Due to this effect of self-discharge, the state of the battery should be checked regularly during its storage period (for example, if you decide not to use your vehicle over a certain period of time) as the battery may require recharging and this should be done when necessary.

11 What is the effect of temperature on the performance of a battery in general?

Of all the environmental factors, temperature has the greatest effect on the charge of the battery and its discharge behaviour. The reason lies with the electrochemical reactions that depend on temperatures and occur during the electrode-electrolyte interface, which are regarded as the very heart of the battery. If the temperature drops, the value of the electrode reaction also decreases. If the battery voltage remains constant but the discharge current drops, then the battery power output will also decrease. The opposite effect occurs if the temperature increases, namely, the battery power

output will increase.

Temperature also affects the speed of the transport process within the electrolyte and its porous electrodes. A rise in temperature speeds up the transport processes and a drop in temperature slows them down. The charge/discharge performance of the battery may also be affected. The higher the temperature, the greater the rate of self-discharge will be, and vice-versa.

The effects of relative humidity will depend on the battery system. These play a key role in “open” battery systems (in contrast with closed battery systems).

12 What effect does heat have on the battery?

Extreme heat causes the water in the battery electrolyte to evaporate. Additionally, heat speeds up the corrosion of the positive battery grid. In the long term, these conditions will adversely affect the service life of the battery. Avoid using or storing a battery at high temperatures.

13 Can I use a starter battery for other purposes?

Each battery should be used only according to what is recommended for it in order to ensure optimum performance. There are many types of batteries, including starter batteries for cars or trucks, batteries for motorcycles, semi-traction batteries etc.

They differ one from the other, not just in their external appearance, but also in their internal technology. For example, the layout of the positive and negative grid may differ (thicker/thinner, weaker/stronger grid structures), different lead alloys may be used for the positive and negative grids and different separation materials may be used. So, each battery is optimised for a particular application and may not give full performance if used for another purpose.

14 Why should you not use a starter battery as a power supply source for long periods of time?

The main task of a starter battery is to supply a high electrical power output for a short period of time, which is what is needed to start a combustion engine. Electrodes with large surface areas are necessary in order to deliver such high outputs of electrical current. This is achieved by using a large number of thin electrodes connected up in parallel.

Performing this cycle on a permanent basis, that is, with a 60% to 80% charge and discharge of the nominal capacity with average currents over a long period of time, can generate strong mechanical forces within the thin battery plates. Such forces can cause a separation of the active material from the electrode grids and result in premature battery wear. Therefore, for a discharge of 60% to 80% of the nominal battery capacity, use special batteries that were designed for the particular type of application.

FAQs

15 What is the electrical system of a vehicle?

Basically, the electrical system of a vehicle comprises an energy storage device (the battery), a device for converting (the generator) and several consuming devices (electrical equipment).

The starter motor (an electricity consumer) starts the engine using electrical power supplied by the battery. When the engine is running, the generator converts mechanical energy into electrical energy and, depending on the revolutions per minute (rpm) of the generator and the amount of electrical equipment connected up, under ideal conditions there will be enough energy to feed all of the consuming devices and charge the battery. If the load demanded by the electrical equipment is greater than the current supplied by the generator, the voltage of the vehicle’s electrical system will drop below the battery voltage and cause it to lose its charge.

16 How does the charging system of a car work?

The charging system of a modern vehicle comprises two components:

- **The alternator:** This is a mechanical device that is driven by a secondary belt from the engine. It supplies the continuous voltage needed to recharge the battery while the engine is running.
- **The voltage regulator:** This monitors the state of charge of the battery and adjusts the activity of the alternator according to what is needed for charging the vehicle’s battery and supplying the power needed to operate the vehicle’s accessories.

17 What do I need to do to install or remove the battery from the vehicle?

Modern vehicles are equipped with sensitive electrical systems, such as airbag controllers, ABS, stability and traction control systems, onboard computers etc. With some vehicles, it is necessary to follow certain procedures when installing or removing the battery. So, be sure to adhere to the vehicle manufacturer’s instructions!

The following steps need to be taken:

- Switch off the engine and all the other electrical equipment before installing or removing the battery.
- Install only batteries that are fully charged and undamaged.
- Install the type of battery recommended for the vehicle.
- Avoid causing short-circuits with the tools or cables.

- When removing the battery, disconnect the negative terminal (-) first followed by the positive terminal (+). Before installing the battery, clean the surface of the installation location.

- Fix the battery firmly in place. If it is not firmly fixed in place, it will be affected considerably by vibrations and this can reduce its service life. Friction between the battery container and its support area can result in wear to the container, causing it to break and the electrolyte to leak out.

- Clean the battery terminals and the connection terminals. Lubricate them lightly with non-acidic grease to prevent oxidation.

- When installing the battery, connect the positive terminal (+) first followed by the negative terminal (-). Check that the terminal connections are firm, but do not over-tighten them.

- Use the fittings from the old battery, such as the hose connection, terminal supports and terminal covers. Use the top-up caps supplied.

18 Tips for extending the life of your battery

1. The battery surface areas should be kept clean and dry. Otherwise, leakages of current may occur, causing an additional loss of charge. Use only a damp anti-static cloth to clean the battery. Check from time to time that the battery and its terminals are properly in place. Tighten them, if necessary, but do not use undue force so as not to damage the battery or the terminal connections.
2. Batteries should always be kept with the largest amount of charge possible so as to prevent the formation of large lead sulphate crystals. Never store batteries in a discharged or partially discharged state!
3. Check stored charged batteries regularly and recharge them when the acid density falls below 1.20 kg/l or if the open circuit voltage (OCV) drops below 12.4V.

19 Should I add water to the battery?

No, the Bosch S3, S4 and S5 (100% maintenance-free batteries), require no water replacement during their entire service life (thus they are totally sealed).

20 How often should I replace my battery?

The service life of a battery varies from one vehicle to another and it depends on many factors. If the performance of the vehicle’s starting system is poor, or if a failure is shown on the dashboard instrumentation, take the vehicle to a workshop to have the electrical system / starter system checked.

FAQs

If you install additional electrical equipment in the vehicle, such as amplifiers, navigation systems, electrical window openers, etc., be sure to also install a battery with a larger capacity. The original size of the battery suggested by the vehicle manufacturer corresponds to the original equipment of the car. Additional electrical equipment will use up more energy from the battery and this will result in a permanent state of low charge if you do not install a larger battery. A permanent state of low charge will result in the reduction of the service life of your battery.

21 It doesn't seem possible to recharge the discharged battery.

If a battery is stored for a prolonged period in a state of low charge, the grids experience sulphation, a process in which the active material is transformed into white sulphuric acid (an irreversible state). The longer it is left in this state, the more difficult it becomes to recharge the battery. So, recharge any discharged battery as soon as possible.

A battery with deep discharge should be charged with 1/20 of the capacity of the battery. If it does not recharge under these conditions, you will need to replace it.

Any attempt to charge it using a larger current will probably damage it and result in its complete discharge. Recharging a battery with deep discharge using a high-power charger will, at best, have no effect or worse cause permanent damage to the battery.

22 What kind of problems could arise during use?

- Low charge level: This is caused by a defective alternator, extremely short journeys or an excess of electrical equipment. Dirty terminals can cause a loss of current. The battery is not fully charged and parts of the active material have become inactive (sulphation). The consequences are a loss of capacity and reduced starting power.
- Overcharging: This is caused by a defective voltage regulator. Overcharging results in high water consumption, extreme electrode corrosion and severe damage to the battery.
- Strong cyclical use: This is caused by numerous discharging and recharging deep cycles. Usually, these charges do not occur under normal circumstances, unless the starter battery is frequently activated in congested traffic with lots of stop-start activity, or when it is used for other purposes, for example in taxis, to operate loading platforms on trucks or as a traction battery (there are special batteries for such applications).
- Wrong size of battery: Choosing a battery with an inadequate capacity for a vehicle results in a larger cyclical charge and damage to the battery.

Such damage also results from excessive power consumption by electrical equipment installed subsequently (for example, sound systems, portable telephones, stationary heating).

23 How can I do a simple check for poor battery operation?

Perform the following list of steps, one at a time, to check the state of the battery.

1. **Check the outer surfaces of the battery.** Damage (for example, cracks) to the external surface of the battery can cause leakage of electrolyte which, in turn, results in corrosion of the car. A dirty battery surface can cause discharge. So, keep it as clean as possible. Use only a damp anti-static cloth for cleaning.
2. **Check the charge indicator.** Bosch S5 and S6 starter batteries are fitted with a charge indicator. It is a fast and convenient way to get a first impression on the state of charge of the battery.
3. **Measuring the voltage (OCV).** Let the car engine rest for about one hour after switching it off before measuring the voltage. Based on the measured value of the voltage, you can work out the state of charge. The voltage of your battery should be between 12.2V and 12.8V. A voltage that is lower or higher may be an indication that there is a fault in the electrical system of the car or that the battery is damaged. In these cases, have the battery checked at an authorized workshop.
4. **Check the battery using a professional battery testing instrument.** Check with the nearest authorised dealer for more information concerning the state of the battery.

24 What are some of the causes of battery discharge in a car?

- Forgetting to turn off electrical equipment, for example, fog lights or improperly shut doors that keep the dome light switched on.
- The electricity load exceeds the capacity of the vehicle's alternator. For example, when the car is stopped the generator supplies only 10% to 30% of its capacity. Discharge may occur if there is an excessive demand for electrical power at such a time.
- An increase in the number of electrical accessories in the car. The capacity of the generators may not be adequate for feeding all the accessories.
- Long journey times at low speed or electrical overcharging during night trips. For example, driving in urban traffic, proceeding with many stops and starts, or on congested roads, together

FAQs

with an excessive use of the air conditioning or other electrical components.

- Problems with the voltage regulator or with electrical components.
- Loose connections between the terminals and the cables.
- Leaving the vehicle parked for long periods of time.
- Poor operation of the starting device (ignition), requiring excessive ignition.
- Loose fan belts, which reduces the capacity of the generator.
- The wearing of wire insulations in older cars caused by abrasion, which can cause the current to leak to other parts of the car.
- Spent batteries.

25 What should I do with my old or damaged battery?

Car batteries contain lead and sulphuric acid. These materials are hazardous if disposed of in regular refuse or thrown out in the open. Most of the battery and its materials are recyclable. To help protect the environment, adhere to the following instructions:

- Never dispose of spent batteries or their components in domestic refuse.
- Stores, manufacturers, importers and scrap dealers take spent batteries and send them on to secondary foundries for recycling. When you buy a new battery, hand in the spent one to the workshop.
- If a battery is destroyed or damaged, the leaked electrolyte, lead plates and separators should not be disposed of in domestic refuse. Place these materials in an acid-resistant box and return them as you would do with any other spent or undamaged battery.
- The electrolyte and diluted sulphuric acid should never be emptied [by someone] without specific technical knowledge. Never allow the electrolyte to get into the sewer system, the soil or the water table.

26 Can the batteries be recycled?

At present, lead-acid batteries are used in practically all vehicles.

How is the battery recycled?

- The acid of the battery is recycled by neutralising it in water or by converting it into sodium-sulphate or powdered detergent, or by using it in glass and textile production.
- The plastic is recycled by cleaning up the battery container, melting it down and transforming it into plastic pellets which will be used once again for manufacturing batteries.
- The lead, which accounts for 50% of each battery, is melted down into bars and refined. The lead retains all its characteristics after having been refined and can be used for the production of new batteries.

Bosch Batteries: **Advantages** for your battery business



100% maintenance free

All Bosch batteries are totally sealed and require no water replacement during their entire service life.

Fast, reliable starting power

Safe starting in any weather and resistant to high engine chamber temperatures.

Attractive retail packaging

Strong, sturdy packaging protects the product and improves its appearance in-store. The packaging also lists the features and benefits to help your customers understand the advantages of Bosch batteries.



Meets the demands of modern vehicles

Meets the growing demands of modern vehicles with advanced electrical components.

Compact battery program

Comprehensive market coverage within a compact program for ease of selection and reduced inventory.

Dependable quality with Bosch Silver Technology

Advanced silver technology which significantly enhances battery performance.

Strong brand

The most trusted brand in automotive parts, with an unparalleled reputation for quality and innovation.



BOSCH
Invented for life

Robert Bosch (Australia) Pty. Ltd.
Cnr Centre & McNaughton Roads Clayton Vic 3168
For further information on **Bosch Batteries** or to find your local Bosch distributor call the Bosch Customer Service Line on **1300 30 70 40**.
Also visit the website at **www.bosch.com.au**