TECHNICAL GUIDE
LEAD-ACID BATTERIES

EUROPEAN EDITION 5

MAKING BATTERY TECHNOLOGY EASIER TO UNDERSTAND

MAKING SENSE OF MODERN BATTERY TECHNOLOGY

With the battery industry changing faster than ever before, Exide has produced this useful guide to make lead-acid batteries easier to understand. Exide is a leading original-equipment manufacturer and is always quick to bring the latest innovations to its aftermarket customers.

Discover how the market is moving forward, make better-informed decisions and offer expert recommendations to your customers. Even if you work with batteries regularly, we are confident you will still learn something new.

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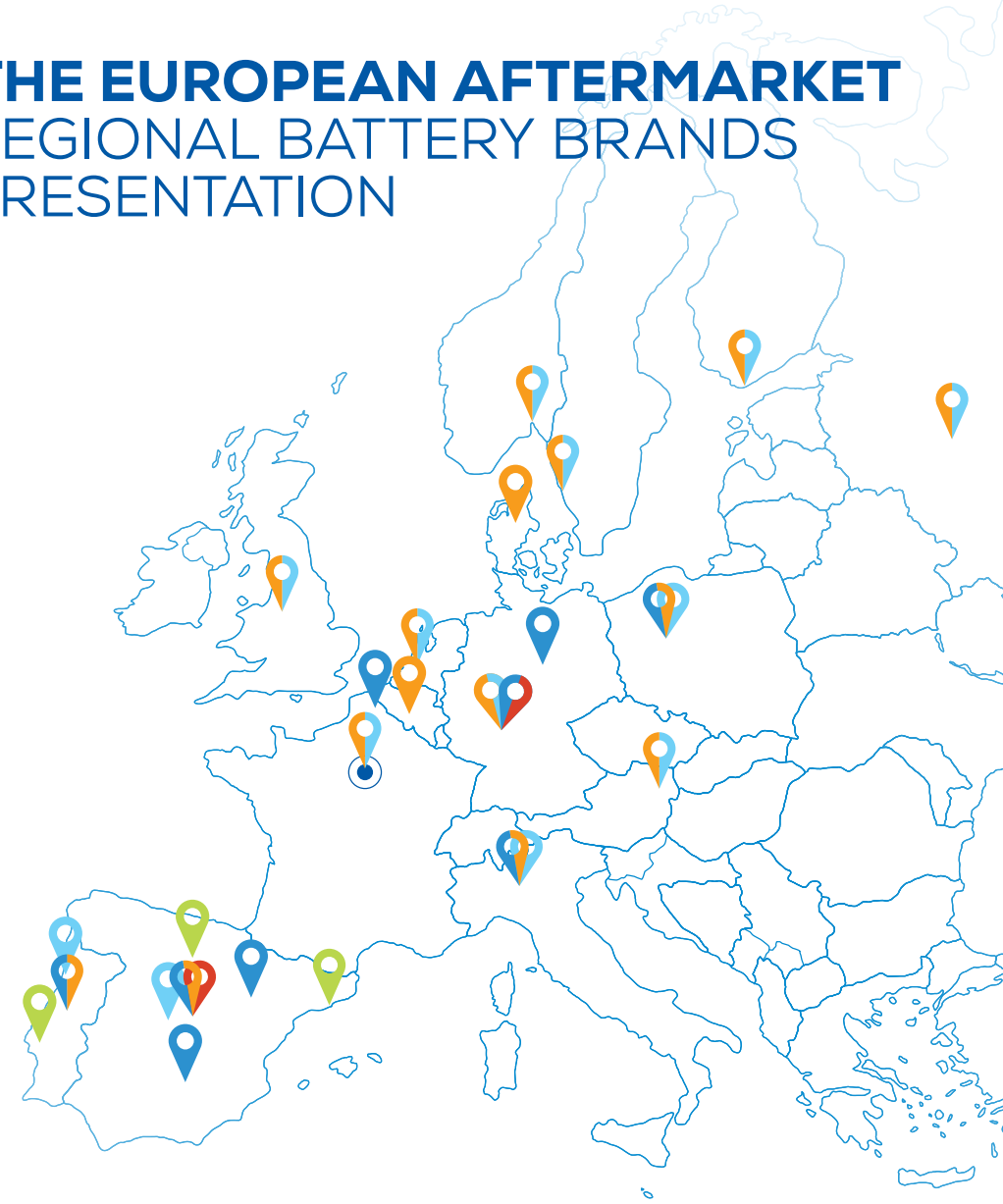
EXIDE SERVES THE EUROPEAN AFTERMARKET WITH STRONG REGIONAL BATTERY BRANDS AND LOCAL REPRESENTATION



- EMEA headquarters
- Manufacturing plants
- Recycling plants
- Distribution centers
- Main sales offices
- R&D centres

Manufacturing plants ISO 9001 and ISO 14001 certified

Automotive plants IATF 16949 approved

Benelux

France

Responsible for...

Morocco
Tunisia
Africa
(other French speaking)

Germany

Responsible for...

Austria
Switzerland

Italy

Responsible for:

Adriatic countries
Bulgaria
Greece
Hungary
Macedonia
Romania
Serbia

Africa
(English speaking)

Egypt

Middle East

Turkey

Nordics

Responsible for:

Baltics
Iceland

Poland

Responsible for:

Armenia
Azerbaijan
Czech Republic
Georgia
Kazakhstan
Kyrgyzstan
Moldova
Slovakia
Tajikistan
Turkmenistan
Uzbekistan
Ukraine

Russia

Responsible for:

Belarus

Portugal

Responsible for...

Angola
Cabo Verde

Spain

Responsible for...

Algeria

UK

Responsible for...

Ireland

EMEA HEADQUARTERS

EXIDE TECHNOLOGIES SAS
5 ALLÉE DES PIERRES MAYETTES
92636 GENNEVILLIERS
FRANCE

TEL: +33 1 41 21 23 00

PAN-EUROPEAN BRANDS

EXIDE® TUDOR® FULMEN® Centra® DETA® GERMANY SONNAK®

THE VITAL COMPONENT
IN MODERN VEHICLES

The lead-acid battery has come a long way since the historical introduction of the car alternator in the early 1960s. Previously, the number of electrical devices in a vehicle was limited by the older DC generator, or dynamo as it was also known.

Although early alternators had a much lower capacity than those fitted in today's vehicles, it was enough to allow car manufacturers to introduce more electrical devices. The cavernous space under the bonnet was soon filled with a vast array of new electrical and mechanical components - it is difficult to imagine now how great the desire was for something as simple as a radio or electric windscreen wipers.

And it did not stop there. Electrical circuits and motors continued to replace manually operated handles and levers over the years. At the same time, the trend was towards sleeker, more compact body styling. More driver controls, security and comfort devices have placed more strain on the battery. Although still referred to as an SLI (Starting, Lighting, Ignition) battery, its role has become more vital to make everything in modern cars work correctly.

The global shift led by European car manufacturers towards Start-Stop cars in order to cut fuel consumption and reduce CO_2 emissions has put the lead-acid battery once more into the spotlight: Advanced battery designs are needed since Start-Stop batteries have to work much harder and withstand the additional strain of many more thousands of starts during their lifetime.

As a world-leading manufacturer, Exide has constantly met the challenges to make batteries work harder for longer. Exide works with major vehicle makers to produce latest OE batteries that meet an exact specification, deliver constant performance and have excellent lifespan.

Exide applies the same dedication to the manufacture and supply of aftermarket batteries – a vital component in modern cars. For trouble-free motoring, it is important that both installers and end-users replace batteries with the best-quality matching original part.

HOW THE BATTERY WORKS
MUCH HARDER THAN EVER BEFORE

50 YEARS AGO

THE PAST 10 YEARS

TODAY

Basic electrical devices that included lighting, radio and windscreen wipers

Over 100 control units, including climate control, electric windows/ mirrors/seats, mobile communications, satellite navigation, high-quality sound/vision entertainment, enhanced safety features, automatic sensors, Start-Stop battery management control...

MORE INFORMATION

In 1900, the Electric Storage Battery Company developed a battery of greater capacity and less weight for electric taxicabs. It was the first to bear the name Exide, short for...

EXCELLENT OXIDE

A LOOK INSIDE THE BOX

The battery is one of the most important car components, yet what is inside the box is rarely seen. By looking at how a lead-acid battery is made, we can understand the differences between various technologies and pick the right battery for our needs.

Lead Plates

No other material, synthetic or natural, comes close to the unique properties of lead, which has formed the essential building block of rechargeable batteries for the past 150 years. It is also very easy and economically viable to recycle again and again. To give the material the mechanical strength required for high-quality batteries, battery manufacturers such as Exide use a lead-calcium alloy for both positive and negative grids, so-called "calcium-calcium", essential for maintenance-free batteries.

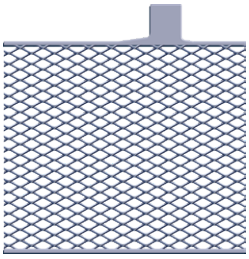
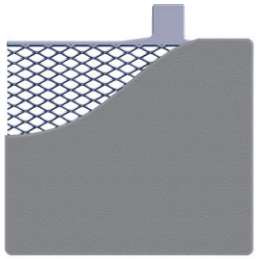
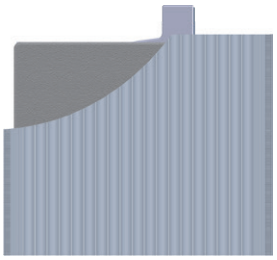
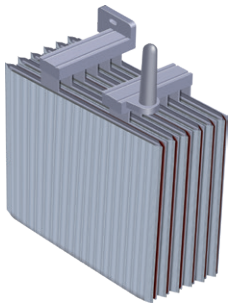
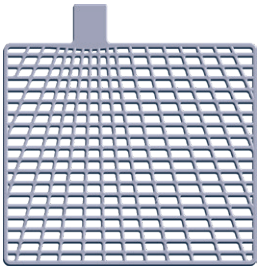
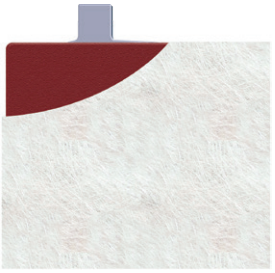
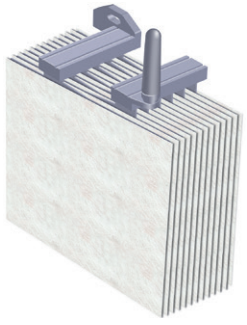
Traditional grids are gravity cast, a method of placing molten lead alloy into a mould before leaving it to solidify. This technique is still relevant for the thicker plates used in deep-cycle AGM and GEL batteries. In more recent years, starter batteries are using new thinner grids, which create a larger surface area without increasing the size of the battery. This provides more starting energy.

New manufacturing processes have emerged that rely on a rolled lead alloy strip. One method is where punched grids are obtained by pressing out metal scrap that is later recovered by re-smelting. Exide was one of the first European producers to refine an alternative method with its 3DX Grid (Expanded Metal), where the lead alloy is slit and then very precisely stretched. The re-processing of punched-out scrap is eliminated and the reinforced 3D diamond mesh ensures that the active mass stays fixed on the mesh, resulting in better electrical performance and longer lifespan.

Cell Assembly

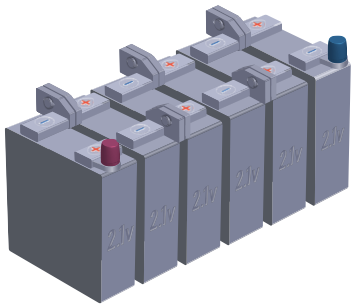
Grids are then pasted with the active materials using lead-oxide powder as the main ingredient. The positive and negative plates, now referred to as electrodes, are assembled in alternating sequence, set apart by microporous separators to form an individual cell. The separator prevents the plates from touching and causing a short circuit, yet still allows ions to freely flow back and forth. After charging, the positive plate becomes reddish-brown, indicating the presence of lead dioxide (PbO2), while the negative plate turns into grey sponge lead (Pb).

LEAD – THE ESSENTIAL BUILDING BLOCK OF RECHARGEABLE BATTERIES FOR THE PAST 150 YEARS

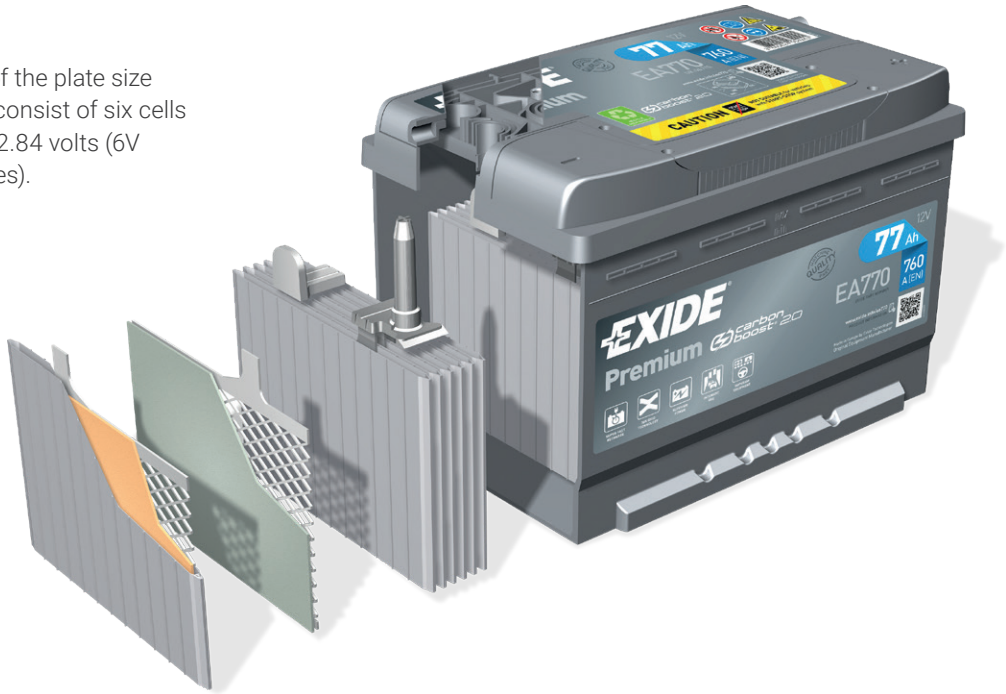
	Grid Manufacture	Active Material Pasting	Individual Plate Finishing	Completed Cell Assembly
	(lead-calcium-alloy)	(lead-oxide)		Alternate +/- plates
FLOODED BATTERY	 3DX grid (Expanded Metal)	 Negative plate example sponge lead (Pb)	 Microporous separator	
AGM BATTERY	 Framed grid	 Positive plate example lead dioxide (PbO_2)	 Absorbent Glass Mat (AGM)	

Combination of cells

Each cell produces 2.16 volts, regardless of the plate size and quality. Modern automotive batteries consist of six cells connected in series to produce a total of 12.84 volts (6V batteries still exist but only on older vehicles).



6 X 2.16 VOLTS =
12.84 VOLTS



carbon boost 2.0

EXIDE EFB

Exide's new EFB batteries feature Carbon Boost 2.0. with exceptional dynamic charge acceptance, offering important benefits for drivers, especially in intensive urban driving conditions.

Benefits

- 75% more energy recovered in the same amount of time compared to older EFB
- Optimized regenerative braking functionality - ensuring fuel savings and reduction of CO2 emissions
- Longer overall lifespan

carbon boost 2.0

EXIDE PREMIUM

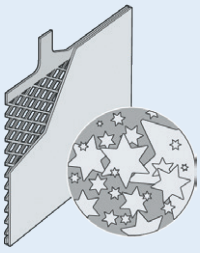
Carbon Boost was first introduced in the aftermarket Premium range in 2014. The new Carbon Boost 2.0. brings performance to the next level.

Benefits

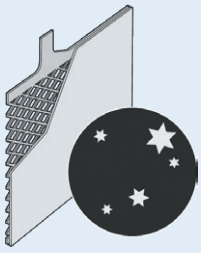
- Faster recharging (2 × times faster than other conventional batteries)
- Longer lifespan (higher average state-of-charge throughout battery life)

CARBON BOOST® 2.0

Carbon Boost® is Exide's unique recipe for carbon additives on the negative plates that was first developed for Exide's Start-Stop OEM batteries. Continuous investments in R&D, tighter emissions regulations and the increasing demands from the OEMs in regards to charge acceptance and energy availability have lead to the development of the new Carbon Boost 2.0. Carbon Boost 2.0 uses improved carbon additives, combining an optimized surface structure with significantly better conductivity. This enables a better current flow within the battery, resulting in unmatched charge acceptance. It also helps to dissolve the lead sulfate deposits that usually consolidate on a battery's discharged negative plates, reducing its ability to charge back efficiently.



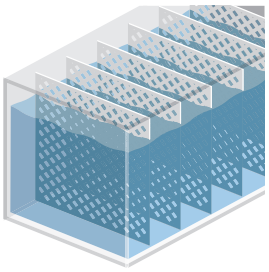
WITHOUT CARBON BOOST
The plates are covered with sulfate



WITH CARBON BOOST
Sulfate is reduced due to Carbon Boost technology

LEAD-ACID BATTERY TYPES

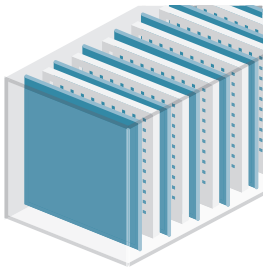
CONVENTIONAL
(STANDARD FLOODED) STARTER BATTERIES



This is by far the most common automotive battery today. The name 'flooded' refers to the plates being immersed in an electrolyte made from 36% sulphuric acid and 64% distilled water. Thanks to the lead-calcium alloys of the grids, Exide car batteries show very little water consumption. The individual cells are no longer accessible through individual plugs, protecting against accidental acid spillage in normal motoring and so avoiding unnecessary servicing.

The Exide Premium Carbon Boost battery features a heat-sealed double lid with a patented labyrinth for unbeatable security, ensuring a safe flow-back of acid particles that is designed to withstand the roll-over test. Provided the starter battery is not subjected to long periods of low charge, it will have a long service life and excellent performance throughout.

AGM
ABSORBENT GLASS MAT BATTERIES

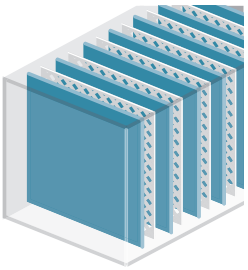


Instead of the conventional polyethylene separator, the plates of AGM batteries are enveloped with a glass mat that absorbs the electrolyte and maintains direct contact with the plate's active material. This greatly enhances both discharge and recharge efficiency, resulting in high performance engine starting and high cycle capabilities. The physical bond between the battery components and the container makes AGM spill-proof and the most resilient battery to vibrations and tilting at high inclinations.

AGM can be used for Start-Stop cars with regenerative braking and coasting, and as a high-endurance starter battery for utility and emergency light vehicles. Other applications include off-road, motorbikes and marine/leisure, dual start/supply.

...AND THEIR APPLICATIONS

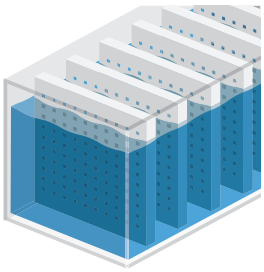
EFB
ENHANCED FLOODED BATTERY BATTERIES



Developed by Exide in partnership with major European car manufacturers, the EFB battery combines 3DX Grid plates with higher-density active material and additives.

The plate is contained in a polyethylene envelope and combined with a polymat inlay, increasing cyclability. EFB was specifically designed for small to mid-sized vehicles with Start-Stop, regenerative braking and other powerful fuel-saving features. However, the same EFB battery has become a popular choice for any conventional vehicle requiring high endurance and the most reliable starting in intensive urban use, such as by taxis, couriers, emergency vehicles, utility companies etc.

GEL BATTERIES



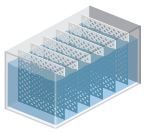
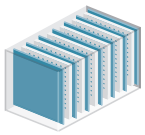
Exide invented the patented GEL battery technology under the dryfit® trademark*. Instead of being in liquid form, the electrolyte is thickened into a gel-like mass. The GEL battery is a highly robust energy-system with best-in-class deep cycle properties, allowing unmatched safe depth of discharge to 90%.

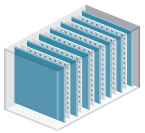
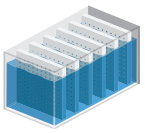
Some manufacturers use the word 'GEL' in the description of their AGM products, but this partial use of the process does not come close to delivering the same performance and benefits. Exide's special patented design of pressure-relief valves results in a fully sealed battery that can be safely stored and used in almost any location or environment, even transported by air. Crucially, GEL also has the smallest volume and weight ratio for the amount of Watt hours supplied.

As an energy supply battery, GEL is the ultimate choice for many demanding applications including boats, motorhomes and caravans. GEL batteries are also essential in the latest commercial vehicles with dual-battery systems, or indeed in any vehicle with extensive electric power needs. The benefits of GEL make it popular in construction, mining, agriculture and industry. The technology is also used to provide remote power, everywhere from local highways to the Arctic Circle.

*GEL was originally invented by Sonnenschein, which is now part of the Exide group

EXIDE BATTERY COMPONENTS & ASSEMBLY

TYPE	Definition		CONVENTIONAL Flooded Battery	AGM Absorbent Glass Mat		EFB Enhanced Flooded Battery	GEL Deep Cycle Battery
Features	Grid Type	⊕	3DX Grid	Lifegrid® Framed Grid	Cast Orbital	3DX Grid	Cast Flat
		⊖	3DX Grid	Framed	Cast Orbital	3DX Grid	Cast Flat
	Separator Method		Microporous Envelope	Absorbent Glass Mat	Absorbent Glass Mat	Polyethylene Envelope/Mat	Polyethylene Envelope
	Electrolyte		Liquid	Absorbed	Absorbed	Liquid	GEL

APPLICATIONS

LIGHT VEHICLE						
Car	Starting	Start-Stop + Regenerative braking + Coasting mode	Start-Stop + Regenerative braking	Starting Start-Stop + Regenerative braking		
Van						
Specialist		Exceptional endurance		Exceptional endurance		
COMMERCIAL VEHICLE						
Delivery Truck	Starting	Starting & Supply	Special applications	Starting & Supply	Separate supply battery use	
Long-Haul Truck						
Bus & Coach						
Construction						
Agriculture						
Specialist						
BIKE						
Motorbike	Starting	High Power Starting + Side Mounting			High Power Starting + Side Mounting + Deep discharge	
Moped						
Quad/Utility						
Garden						
Jet Ski						
Snowmobile						
LEISURE						
Motorhomes	Starting & Supply	Starting & Supply	Starting & Supply	Starting & Supply	Separate supply battery use	
Caravan/Cabin		Supply battery use	Supply battery use	Supply battery use	Supply battery use	
MARINE						
Motor Boat	Starting & Supply	Starting & Supply	Starting & Supply	Starting & Supply	Separate supply battery use	
Sail Boat						

Note that other battery manufacturers may use slightly different materials and configurations

AN INTRODUCTION TO LITHIUM-ION VS. LEAD-ACID BATTERIES

What is Lithium?

Lithium is a chemical element with the symbol Li. It is the lightest metal and the least dense solid element. Traces of Lithium can be found in water, plant-life, food and even the human body. Its high reactivity never occurs freely in nature, but only when lithium is transformed into a compound. Commercial extraction comes from rocks/granite with high abundance of lithium-containing minerals.

What is a Lithium-ion battery?

A Lithium-ion battery or Li-ion battery, is a type of rechargeable battery in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging.

They should not be confused with lithium batteries, which are primary (non-rechargeable) batteries that you may recognise in the form of an AA dry cell or a button/coin cell battery used in your remote car key for example. Lithium-ion batteries are most commonly found in portable electronics due to their high energy density and low self-discharge. This battery type has undoubtedly played a key role in the development and widespread use of today's mobile devices and laptop computers.

What are the main benefits of Lithium-ion?

Lithium-ion offers the highest energy storage to smallest weight/volume ratio of any kind of today's commercially available battery. Very fast recharge and longer life are also very compelling arguments for this battery type.

How do Lithium-ion batteries scale up and challenge applications traditionally performed by Lead-Acid?

Lithium-ion batteries are made up from multiple cells (typically 3.2V or 3.7V) that can be connected in serial configuration to attain the required voltage. To better understand this arrangement, consider two extreme ends of the spectrum. Exide's Motorbike Li-Ion battery contains four cells of 3.2V each, connected in serial to produce a total nominal voltage of 12.8V. At the other end of the scale, Tesla's Model S electric car uses an 85 kWh battery pack containing 7,104 Lithium-ion battery cells.

Are there any disadvantages of Lithium-ion?

The strong plus points come at a significantly higher cost. This is due to more expensive raw materials, complex assembly of

Tesla Model S charging at the Zoutelande dunes, in the Netherlands

components and high precision required in the manufacturing process. To put cost into context, Exide's Li-Ion Motorbike battery costs around 3-4 times more than a lead-acid equivalent and the approximate cost of a Tesla battery pack in 2019 was US$30,000.

Lithium-ion batteries also pose some unique safety hazards. A small fault or damage can create an internal short-circuit and a subsequent build-up of heat. In extreme cases, an overheated battery can possibly burst into flame. Yet this situation is rare and is protected against with a battery management system to prevent operation outside each cell's safe operating range i.e. min-max charge, safe temperature, etc.

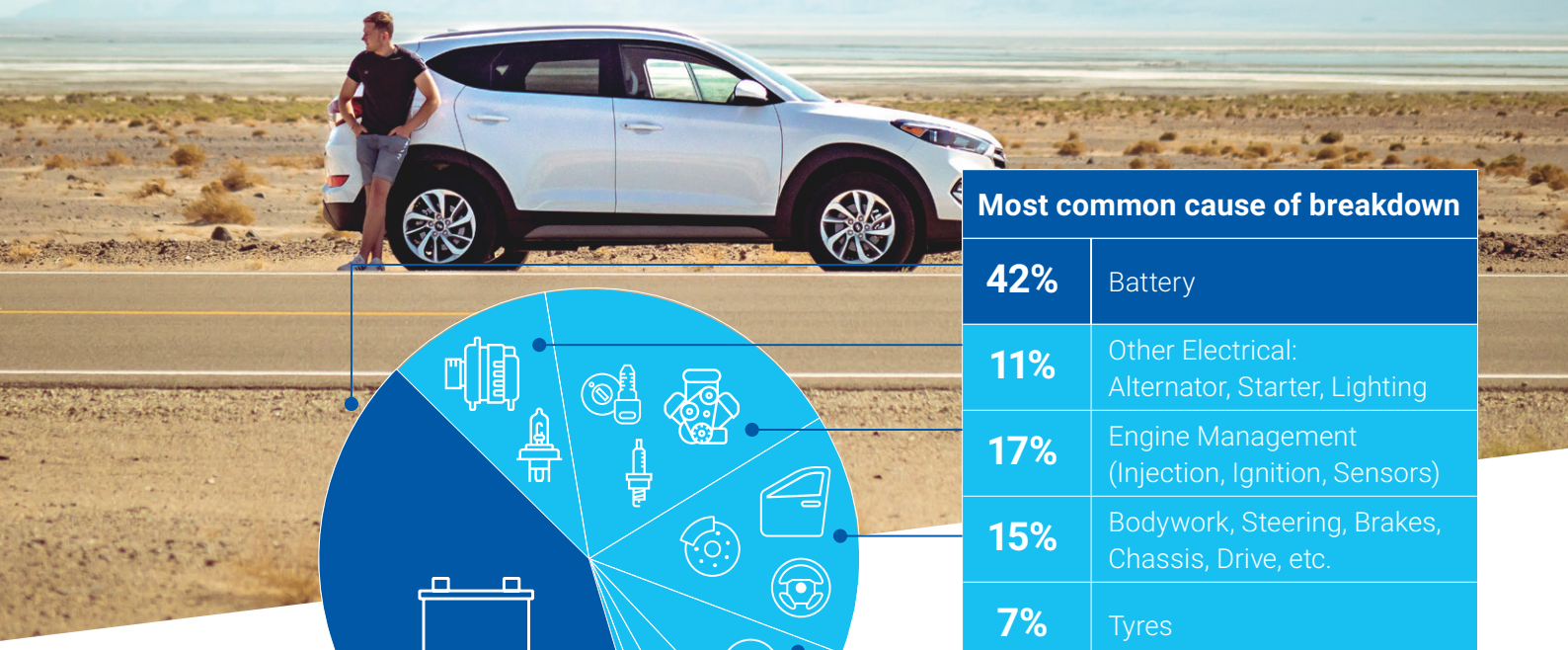
What is the future of Lithium-ion?

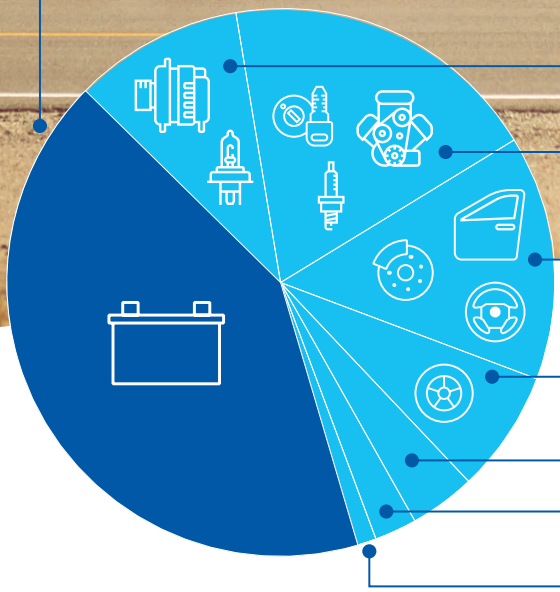
Lead-acid battery technology has come a long way over recent years. It still offers the only economically viable solution to engine starting and the vast majority of supply battery requirements. Continuous development is pushing lead-acid technology beyond its previous limits of performance and has even demonstrated success in new, full electric modes of Personal Rapid Transit. Of course, future developments in Lithium-ion will be focused on reducing battery costs, further improving safety and addressing the question of recycling the end of life product. Within a decade we are likely to see crossover between lead-acid and Lithium-ion in a number of applications, but no great change of dominance of one technology over the other.

Many electric cars still use lead-acid batteries

A 12V lead-acid battery often compliments the main traction battery in electric vehicles to stabilise the electrical system and maintain security/safety features. Learn more about this topic on page 21.

PRODUCT LIFE
AND PERFORMANCE





Most common cause of breakdown	
42%	Battery
11%	Other Electrical: Alternator, Starter, Lighting
17%	Engine Management (Injection, Ignition, Sensors)
15%	Bodywork, Steering, Brakes, Chassis, Drive, etc.
7%	Tyres
4%	Fuel System
2%	Cooling, Heating, Air
1%	Exhaust system, Particulate filter, Catalyst

Source: ADAC Breakdown Statistics for Germany 2019

More than 50% of all breakdowns are due to the vehicle's general electrical system. Battery failure is by far the most common cause that can be greatly reduced with regular battery tests.

At 53%, electrical problems are the single biggest cause of breakdowns, according to the latest figures from Europe's largest roadside breakdown service. In Germany alone, over 640,000 call-outs per year are due to a defective or discharged battery. If the driver is away from home or desperate to get started, it results in a costly battery replacement on the spot.

In many cases, issues with an aging or neglected battery can be picked up during a service through a routine battery test. Sometimes a simple charge with a good battery charger is all that is required, but if the battery needs to be replaced, it is far better done in the workshop. The inconvenience of a breakdown is avoided, the risk of losing valuable information from the on-board computer is reduced, and the workshop makes the sale.

A shorter than expected battery life is often the result of short-distance driving or the use of too many electrical devices. Storage, handling, loose fitting and the environment can all have a negative effect on the battery. Occasionally a faulty alternator can take its toll on the battery. Regular testing of both battery and starter/alternator avoids most unexpected car breakdowns.

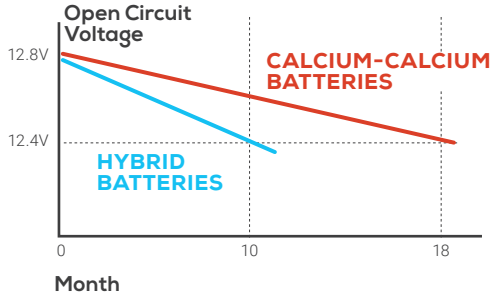
BATTERY SELF-DISCHARGE

All lead-acid batteries suffer from self-discharge. The pace of this self-discharge depends on the storage conditions and the technology. Generally, the cooler the storage conditions, the slower the self-discharge. Calcium (Ca)-Calcium (Ca) batteries, such as conventional flooded (maintenance-free) car and truck batteries, have a lower self-discharge than Antimony (Sb) Calcium (Ca) conventional batteries (Hybrid) like some marine/leisure and truck batteries with filling plugs for water top-up.

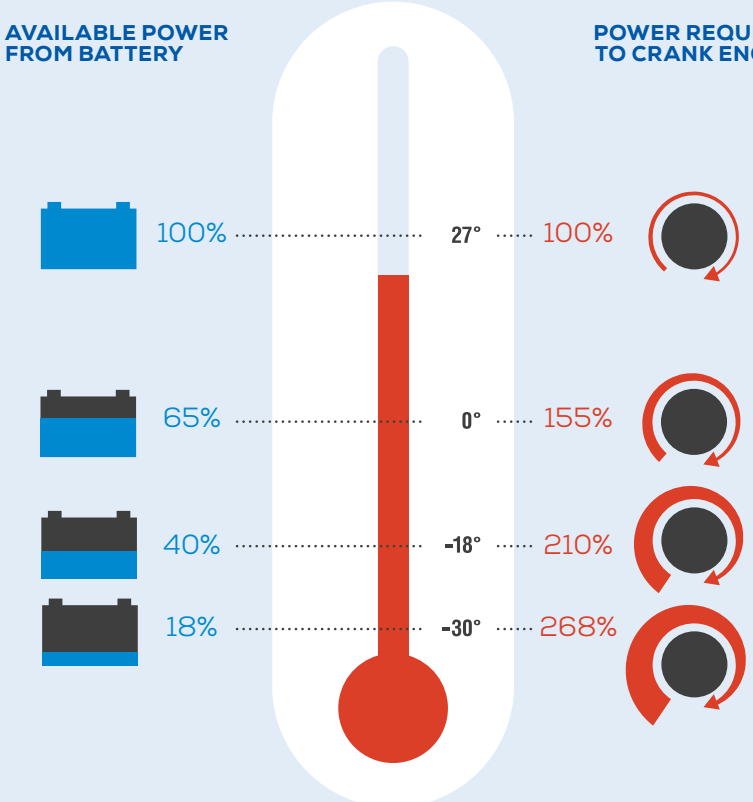
This is important for both distributors and battery users. Distributors have to make sure that the FIFO (first-in, first-out) rule is applied for stock management. At the same time, the voltage of the batteries should be regularly controlled: when the voltage drops to 12.5V, the battery needs to be recharged to avoid shortening the battery's lifespan and introducing performance problems.

People who only use their battery for short periods during the year (such as motorbike, motorhome, caravan or boat owners) have to ensure that their batteries are fully recharged before storing them away. They should also regularly check/recharge them during storage time.

SHELF-DISCHARGE OF BATTERIES SHELF LIFE AT 20ºC



HOW TEMPERATURE AFFECTS ENGINE STARTING



MAIN REASONS FOR REDUCED BATTERY LIFE

Short distance trips with maximum loads

Incorrect application or short circuit

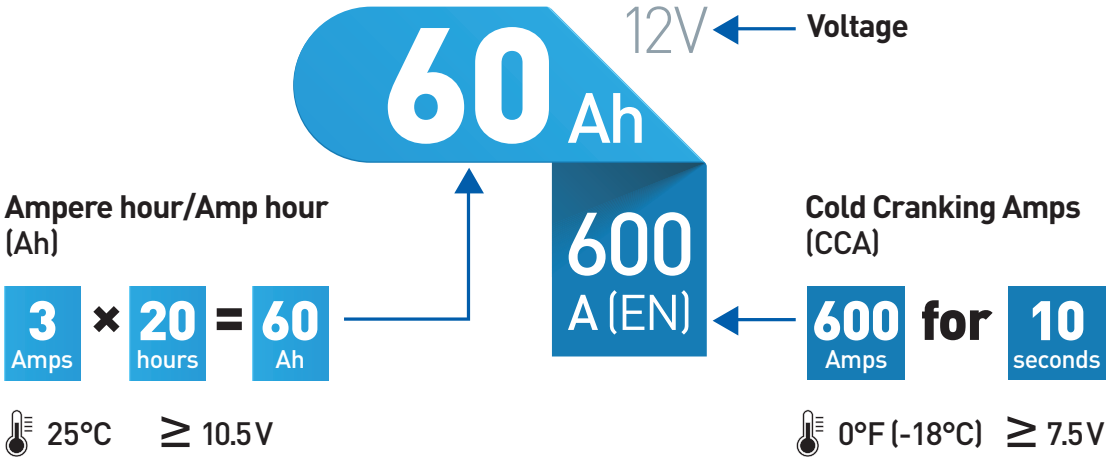
Loose fitting and box damage

Prolonged periods of self discharge

Overcharging with risk of drying out

Extreme temperature

BATTERY CAPACITY
THE NUMBERS EXPLAINED



Electrical voltage (V)

With a few exceptions, current vehicles are only equipped with 12V starter batteries. It was not always the case which explains why some vintage cars that are still running require special 6V batteries.

In this situation it is inadvisable to install a 12V battery, as the electrical components would be destroyed by the higher voltage. Large commercial vehicles usually operate a 24V system. To achieve this two heavy-duty 12V batteries are connected in series.

Ampere hour or Amp hour (Ah)

The Amp hour rating is a measure of the electrical energy stored in a battery. It is defined by the amount of energy, a battery can deliver continuously without recharging for 20 hours at 25°C, without falling below 10.5 volts. For example a 60Ah battery will deliver a current of 3A for 20 hours (3 x 20 = 60).

For a small car with only a few electrical devices, a battery with 40-45Ah maybe sufficient. Premium vehicles and sports cars are generally equipped with batteries with capacities of up to 110Ah. Commercial vehicle batteries can be rated up to around 240Ah. The charge capacity of a battery reduces with increasing age and other factors such as ambient temperatures and humidity.

The Ah rating on the label is a legal requirement on all starter batteries sold in Europe, but this can differ in other parts of the world. North America for example uses Reserve Capacity (RC) which reflects the discharge time in minutes at a 25A discharge.

Cold Cranking Amps (CCA)

CCA is another important rating to consider. It specifies the battery's ability to start an engine in cold temperatures. In general, it is much easier to crank (start) an engine in a warm environment than in a cold one. The rating refers to the current, a 12-volt battery can deliver at 0°F (-18°C) for 10 seconds whilst maintaining a voltage of at least 7.5 volts. The value on the label is determined by a precise test procedure, which in Europe is defined by EN50342-1 standard, and must comply with requirements of EU.Reg.1103/2010.

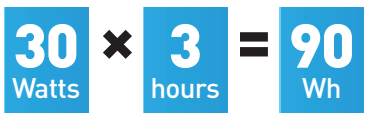
The higher the CCA rating, the greater the starting power of the battery. Replacement batteries should always be equal or exceed the OE battery in ratings. Fitting a new battery that has a lower CCA than the original equipment could result in poor performance.

Watt hour (Wh)

Watt hours are a useful measurement for deep-cycle supply batteries, used to power lighting and appliances for marine/leisure applications. Unlike the short burst of high energy required from a starter battery, the need here is for long, slow duration of electrical loads.

First calculate a load such as a 40 Watt television switched on for 3 hours (40W x 3 hours = 120Wh). By adding all the appliances (W) x required duration (h), we can work out a total electrical need between battery recharges. This might be met by a single battery or a multiple bank of batteries. This subject of supply batteries and power calculation is covered in more detail on page 40.

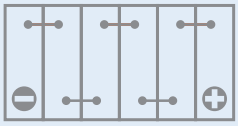
Watt hours (Wh)



LV BATTERY FEATURES

POLARITY

0



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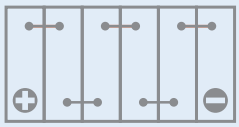

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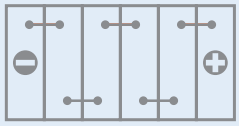
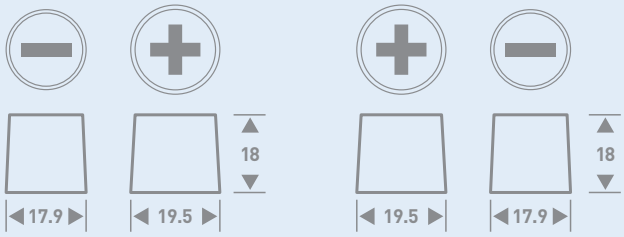
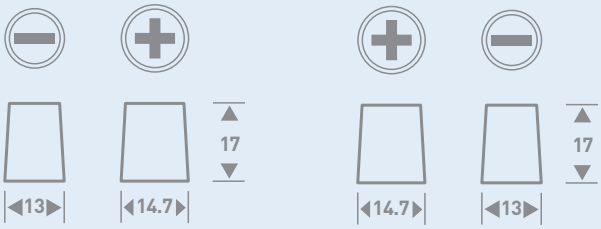


TERMINALS

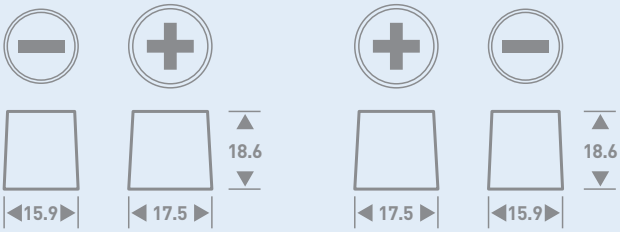
EN Posts



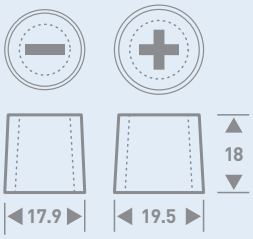
JIS Posts



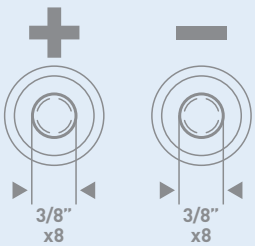
SAE Posts



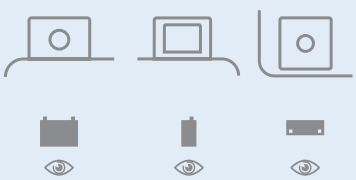
Post Adaptor



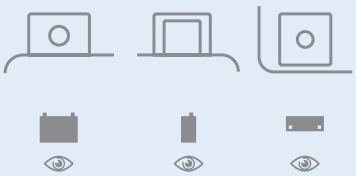
Side Posts



M04



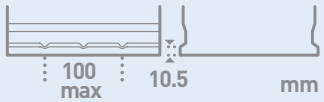
M12



HOLD DOWNS

B00

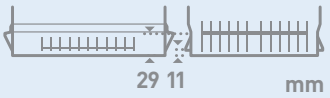
B01



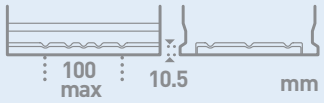
B03

B07

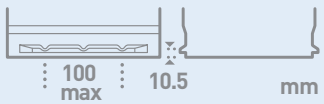
B09



B13

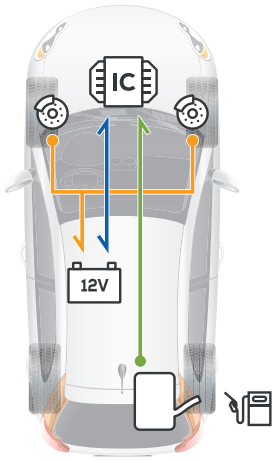
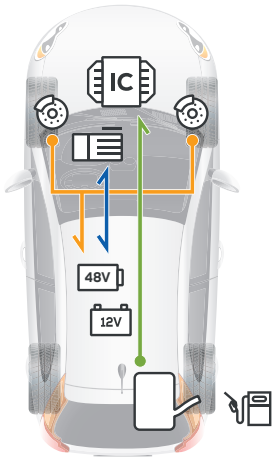
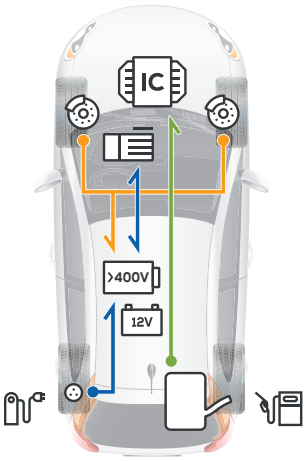
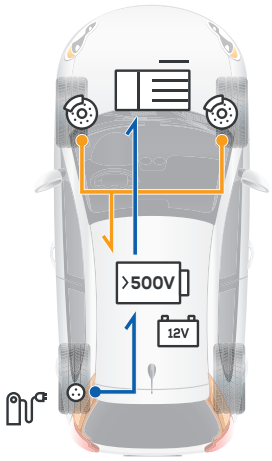


Korean B1



THE ROAD AHEAD

Full electric cars still represent a very small percentage of the European car parc. Mild and Full Hybrid cars are entering the market, but Start-Stop (Micro-Hybrid) remains by far the most popular technology with car manufacturers.

START-STOP MICRO-HYBRID	MILD-HYBRID	FULL-HYBRID OPTIONAL PLUG-IN TYPE	ELECTRIC
			
FUEL/POWER INPUT			
Fossil*	Fossil*	Fossil* Electric	Electric
VEHICLE PROPULSION			
IC Full Engine	IC Engine supported by electric motor ...especially coasting and acceleration	IC Engine or electric motor ...subject to available battery energy	Full Electric
BATTERY TECHNOLOGY			
12V AGM or EFB 12V AGM or Li-Ion Auxiliary	48V Lithium-ion 12V AGM or Li-Ion Auxiliary	>400V Lithium-ion 12V AGM or Li-Ion Auxiliary	>500V Lithium-ion 12V AGM or Li-Ion Auxiliary
ENERGY EFFICIENCY			
Start-Stop + Regenerative braking & coasting (optional)	Start-Stop + Regenerative braking & coasting	Start-Stop + Regenerative braking, coasting & kinetic	Regenerative braking & coasting
REDUCTION IN CO_2			
2-10%	12-20%	15-30%	≤ 100% Subject to level of renewable energy
2020 EUROPEAN LIGHT VEHICLE MARKET BY PROPULSION TYPE			
44% 53% Standard Cars	1% 53% Standard Cars	1% 53% Standard Cars	1% 53% Standard Cars

* Fossil fuels include: petrol, diesel and CNG

Source: LMC & Exide estimates for EU27 + UK & EFTA

EU REGULATIONS
FOR THE REDUCTION OF CO_2

Start-Stop technology is favoured by most car manufacturers to reach targets and avoid EU penalties

During a global push to reduce CO_2 emissions through various forms of carbon taxes, some regions, as net importers of oil, have much more to gain by saving energy. This explains why automotive development in greener cars has been most vigorously pursued in Europe and Japan, where end-users in these markets are more attracted by the offer of better fuel economy.

Citroën launched the first commercially viable Start-Stop cars in 2004. As a development partner and OE supplier to Citroën, Exide produced the first AGM battery for these new models. Other early adopters of Exide Start-Stop batteries included BMW, Toyota and Fiat, plus many more car manufacturers in the meantime. From those early days, sales of new Start-Stop cars are overtaking standard combustion engine models and there is now a growing demand for AGM and EFB batteries in the aftermarket.

In an ever-changing world, Exide continues to develop new batteries to enable future vehicles to reduce CO_2 emissions even further and improve overall driving efficiency.

WLTP
WORLDWIDE HARMONISED LIGHT VEHICLE TEST PROCEDURE

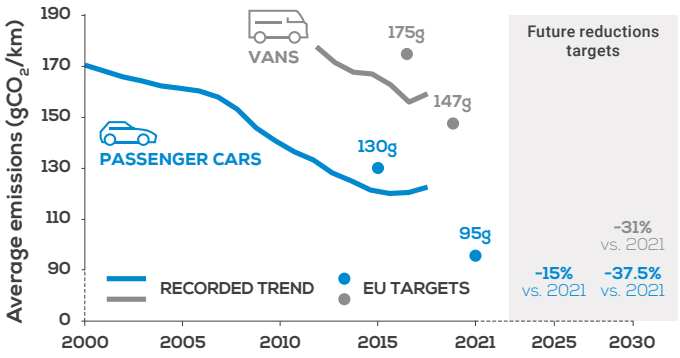
The new WLTP became mandatory in the EU for all new passenger cars in 2018 and for all new vans in 2019. Compared to previous testing, WLTP is more representative of real driving conditions and measures CO_2 emissions more accurately.

The battery should retain a high percentage of its initial capacity to help car makers avoid WLTP penalties when passing certain thresholds. Since the recharging process accounts for only 8% of test duration, the battery needs to achieve the highest possible energy recovery in a short time. Exide Carbon Boost 2.0 ensures that the dynamic charge acceptance of EFB batteries is maximised. Compared to previous EFB generations, the battery now accepts 75% higher average recharging current and maintains a higher capacity.

More information available at: **www.wltpfacts.eu**

Provided by The European Automobile Manufacturers' Association (ACEA)

LIGHT VEHICLE AVERAGE CO_2 EMISSIONS
EU27 + ICELAND & UK



Source: European Commission

PROJECTED EUROPEAN LV BATTERY UNITS (MILLION UNITS)

	2015	2020	2025
Li-Ion			
High Voltage EV	0.35	1.80	5.59
48V (Mild Hybrid)	0.05	1.34	6.71
12V Lithium		0.16	1.37
Total Li-Ion	0.4 0.5%	3.3 4.0%	13.7 15.0%
Lead-Acid Start-Stop	17.0 21.0%	27.2 31.0%	33.1 36.0%
Conventional	63.0 78.5%	56.3 65.0%	44.9 49.0%
Total Lead-Acid	80.0 99.5%	83.5 96.0%	78.0 85.0%
Total (million batteries)	80.4	86.8	91.7

Accessible technology for the IAM

Fastest growth: AGM & EFB Start-Stop Batteries

Source: LMC & Exide estimates for EU27 + UK & EFTA, Russia, CIS &Turkey (2020).

A NEW GENERATION OF BATTERIES

SPARE ORIGINAL PART

EXIDE AGM

Absorbent Glass Mat

Ideal for large cars, SUVs, vans and vehicles with Start-Stop and power-hungry electrical equipment

ABSORBENT GLASS MAT | SUPERIOR POWER | REGENERATIVE BRAKING | INTENSIVE USE | RECOMMENDED FOR START-STOP

EXIDE EFB

Enhanced Flooded Battery

Ideal for small to mid-sized cars with Start-Stop or extra life for conventional vehicles

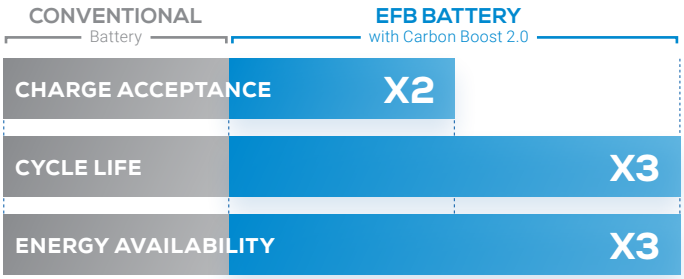
3DX GRID TECHNOLOGY | REGENERATIVE BRAKING | INTENSIVE USE | RECOMMENDED FOR START-STOP | EXTRA LIFE FOR CONVENTIONAL & START-STOP VEHICLES

START STOP

Designed and built to endure continuous battery discharge and recharge of Start-Stop systems.

Typical pattern of State of Charge during a journey with Start-Stop system

Exide EFB offers significant performance advantages over a conventional battery also when fitted into a car without Start-Stop system.



Today's conventional car battery has come a long way, but the tasks of starting the engine and supplying stored energy for lighting, driving and comfort controls have remained largely unchanged. However, the new generation of Start-Stop cars puts far greater demand on the battery to work harder and requires many more thousands of starts during the battery's lifetime.

The global shift led by European car manufacturers towards Start-Stop cars required a totally new kind of battery. Exide's expertise and vast experience in stored energy for automotive and industrial applications put the company in prime position to develop Start-Stop batteries designed to cut fuel consumption and reduce CO_2 emissions.

On the outside, Start-Stop batteries appear very similar to conventional car batteries, but the technology inside the box is vastly different. Even entry-level Start-Stop vehicles demand twice the endurance of the very best premium battery. Larger cars with Start-Stop and those featuring Regenerative Braking require higher charge acceptance and three times the endurance level.

It is extremely important to respect the car manufacturers' specification and always use an Original Spare Part. Exide's Battery Finder (App or online) will ensure the correct match of battery. Incorrect fitment will reduce battery life and the effectiveness of the Start-Stop system.

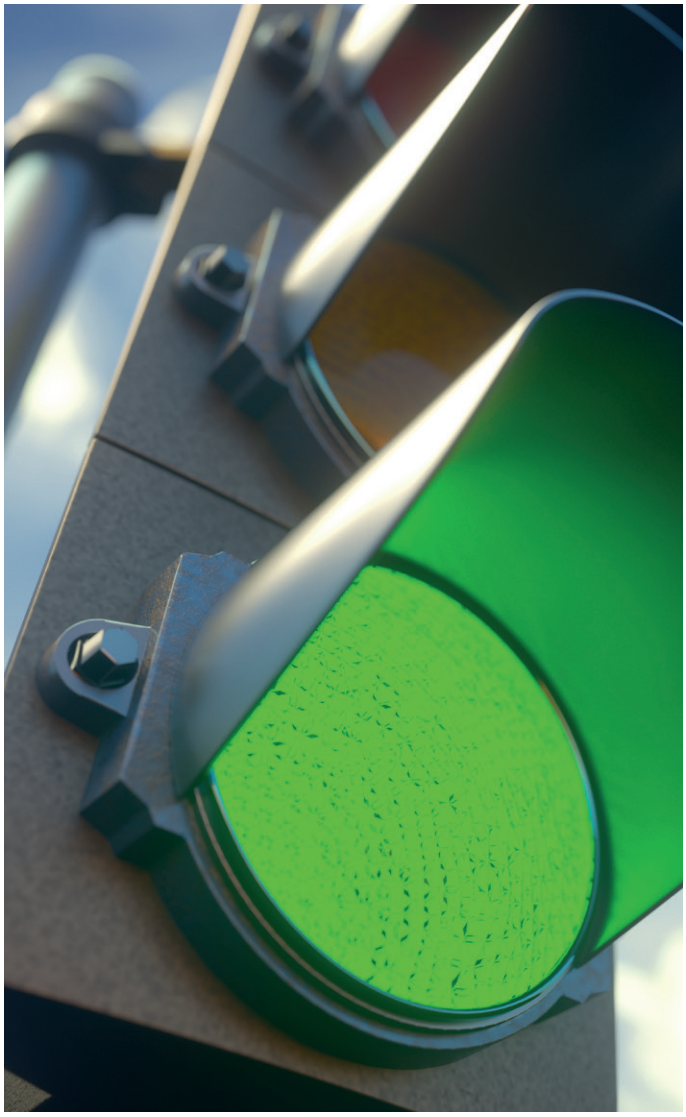
Be cautious of cheaper, less well-known brands, assuming that all AGM or EFB batteries are the same. Only a small number of battery manufacturers meet today's complex Original Equipment specifications. Other AM suppliers may offer a product based on out-of-date designs, produced with cheaper lower grade materials and produced using less precise processes. In such cases, stratification effects can quickly occur, which will have a significant impact on the overall energy and in-cycle voltage stability within the Start-Stop operations.

Image: Citroën Communications

The 2004 Citroën C2 was the first successful production car featuring Start-Stop. To function well, the system depended upon Exide's new AGM battery.

Exide launched the first Start-Stop batteries...
AGM IN 2004 & EFB IN 2008

EXIDE START-STOP AUXILIARY



Auxiliary batteries power the electrical equipment in certain cars, as a complement to the main starter battery

Designed by Exide to meet the latest technical demands from car manufacturers, the new Auxiliary battery provides voltage stabilisation during re-start operations. Exide's Auxiliary battery is proving to be a very cost-effective alternative to other solutions such as a DC-DC converter. The product was able to withstand 250,000 cycles during testing, demonstrating excellent product life expectancy. The mini-EN-shape terminals on this battery are unique in the market.

AGM, EFB & AUXILIARY TYPE LIST

	Exide	Performances		Dimensions				Technical Characteristics		
	Code	Capacity Ah	CCA A (EN)	Container	L (mm)	W (mm)	H (mm)	Hold down	Polarity	Terminals
AGM 	EK508	50	800	G34	260	173	206	B7	ETN 9	1
	EK600	60	680	L02	242	175	190	B13	ETN 0	1
	EK700	70	760	L03	278	175	190	B13	ETN 0	1
	EK800	80	800	L04	315	175	190	B13	ETN 0	1
	EK950	95	850	L05	353	175	190	B13	ETN 0	1
	EK1050	105	950	L06	392	175	190	B13	ETN 0	1
EFB 	EL550	55	480	L01	207	175	190	B13	ETN 0	1
	EL600	60	640	L02	242	175	190	B13	ETN 0	1
	EL604	60	520	D23	230	173	222	B0	ETN 0	1
	EL605	60	520	D23	230	173	222	B0	ETN 1	1
	EL652	65	650	LB3	278	175	175	B13	ETN 0	1
	EL700	70	720	L03	278	175	190	B13	ETN 0	1
	EL752	75	730	LB4	315	175	175	B13	ETN 0	1
	EL800	80	720	L04	315	175	190	B13	ETN 0	1
	EL954	95	800	D31	306	173	222	Korean B1	ETN 0	1
	EL955	95	800	D31	306	173	222	Korean B1	ETN 1	1
	EL1000	100	900	L05	353	175	190	B13	ETN 0	1
	EL1050	105	950	L06	392	175	190	B13	ETN 0	1
AUXILIARY 	EK091	9	120	C54	150	90	105	B0	ETN 1	M12
	EK111	11	150	C55	150	90	130	B0	ETN 1	M04
	EK131	13	200	C56	150	90	145	B0	ETN 1	M04
	EK143	14	80	C76	150	100	100	B0	ETN 3	Screwed/Lug
	EK151	15	200	C56	150	90	145	B0	ETN 1	Small taper post

EXIDE OE START-STOP BATTERIES

Exide is one of the largest OE manufacturers of Start-Stop batteries, and its AGM and EFB ranges are readily available as high-quality replacement parts for all European Start-Stop cars.

Image: Creative Commons by Jaguar MENA

Image: Creative Commons by Asurnipal

PERCENTAGE OF START-STOP BATTERY TECHNOLOGY USED BY EUROPEAN CAR MANUFACTURERS

AGM

BMW Group	
AGM	**98%**
EFB	0%
Lithium 12V	2%

Mercedes-Benz	
AGM	**98%**
EFB	0%
Lithium 12V	2%

Fiat Chrysler Automobiles	
AGM	00%
EFB	**100%**
Lithium 12V	00%

Geely Volvo	
AGM	**100%**
EFB	0%
Lithium 12V	0%

Hyundai Group	
AGM	**100%**
EFB	0%
Lithium 12V	0%

Renault-Nissan-Mitsubishi	
AGM	00%
EFB	**100%**
Lithium 12V	00%

EFB

Ford Group	
AGM	10%
EFB	**90%**
Lithium 12V	00%

Honda Group	
AGM	00%
EFB	**100%**
Lithium 12V	00%

PSA Group	
AGM	00%
EFB	**100%**
Lithium 12V	00%

Suzuki Group	
AGM	00%
EFB	**100%**
Lithium 12V	00%

Toyota Group	
AGM	00%
EFB	**100%**
Lithium 12V	00%

Volkswagen Group	
AGM	33%
EFB	**66%**
Lithium 12V	1%

Source: Exide Estimates 2019

MOST ELECTRIC VEHICLES ARE EQUIPPED WITH LEAD-ACID BATTERIES

The 12V lead-acid battery remains a reliable power source for the majority of electric and hybrid vehicles. It maintains the entire electrical system before the traction battery is connected and whilst the electric car is parked. Safety systems, security, keyless sensors, clock and the computer memory are all crucial loads, that are supported by the lead-acid battery.

As a leading innovator in lead-acid battery technology, Exide is at the forefront, with a complete range of batteries developed for latest European models.

77% OF ELECTRIC CAR PARC HAS A LEAD-ACID BATTERY
EXIDE PROVIDES THE EXACT MATCH FOR OPTIMUM PERFORMANCE

MAKE	MODEL	YEAR FROM	AGM	EFB	AUXILIARY	PREMIUM	EXCELL
BMW	I3	01/11/17			AGM12-23		
CITROËN	C-ZERO	01/10/10					EB356
HYUNDAI	IONIQ	01/03/16				EA386	
KIA	SOUL II	01/09/14					EB504
MERCEDES-BENZ	B-CLASS	01/11/14	EK600				
MITSUBISHI	I MIEV	01/07/09				EA386	EB356
NISSAN	E-NV200	01/05/14		EL550		EA530	EB500
NISSAN	LEAF	01/11/10					EB454
NISSAN	LEAF	01/08/17		EL550		EA530	EB500
OPEL	AMPERA	01/11/11	EK600				
OPEL	AMPERA-E	01/05/17		EL550			
PEUGEOT	ION	01/11/10					EB356
RENAULT	KANGOO EXPRESS	01/10/11		EL700		EA770	EB740
RENAULT	ZOE	01/06/12		EL550		EA530	EB500
SMART	FORTWO	01/11/09	EK600				
SMART	FORTWO	01/05/17		EL600		EA640	EB620
TESLA	MODEL X	01/09/15					EB357
VW	GOLF VII	01/03/14	EK600	EL600		EA640	EB620
VW	UP	01/07/13					EB440

WORKSHOPS GET READY FOR THE START-STOP AFTERMARKET

Now that Start-Stop batteries have entered the aftermarket, independent workshops can fully rely on Exide's support and products to compete with franchise main dealers and battery specialists.

Exide listened carefully to the views of garage operators before launching the first complete set of 'task-specific' battery workshop tools. These simple, flexible and cost-effective solutions allow garages to exploit the full potential of this rapidly expanding new market. Not two workshops are alike, so this approach enables garages to buy only the tools they need to deal with all battery types, including the most recent Start-Stop batteries.

Award-Winning BRT-12 Battery Replacement Tool – a simple solution for Start-Stop batteries

Start-Stop vehicles are the fastest growing segment of the car parc, with the batteries tied much more closely to the electrical management system and the Electronic Control Unit (ECU).

Some diagnostic equipment are still not capable of dealing with Start-Stop battery replacement, but Exide has been helping to resolve the issue. Working with the diagnostic equipment providers, Exide has made new technical data available that allow software updates for correct battery replacement.

Not all workshops have the latest diagnostic equipment or some may prefer more portable units. This is why Exide provides the BRT-12 battery replacement tool, as it enables any competent technician to professionally check the correct installation of a Start-Stop battery and clear any battery fault warning lights from the dashboard.It is a viable investment that costs around 80% less than full diagnostic equipment. Regular software updates will be continually provided by Exide, as new models enter the market. Simply connect the device via USB to your PC and download the new data.

All workshop operators should review their capability of replacing Start-Stop batteries in the newest models. With Exide's support, it is very easy to adapt quickly to new battery technology and protect or expand the workshop's current business.

Trust Exide to provide the independent aftermarket with high-quality Start-Stop battery products, expert advice and straightforward installation solutions.

TEST, CHARGE OR REPLACE NEW START-STOP BATTERIES WITH EXIDE'S WORKSHOP TOOLS

- Is your workshop ready? Check your existing devices now for compatibility with Start-Stop cars
- If you use diagnostic equipment, ensure your software is up to date and able to complete the job
- Exide supports workshops with individual 'task-specific' tools available at a reasonable price

TEST

EXIDE EBT-965P ELECTRONIC TESTER

Next-generation tester works with all batteries, including those installed in the latest Start-Stop vehicles.

NEW

EBTP EXIDE BATTERY TESTER PROGRAMME

Find the right fitment and propose a replacement to the end-user.

Battery replaced within 5 minutes!

FIND

EXIDE ONLINE BATTERY FINDER AND APP

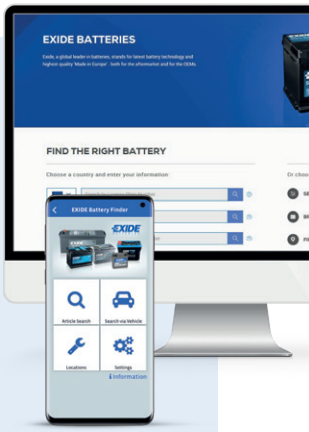
Find the right battery from your computer or your smartphone using the Exide Online Battery Finder - the most comprehensive fitment list on the market (**www.exide.com/eu/en**).

Search by car model, VIN or registration number to find the correct battery.

Exide battery catalogue powered by TecDoc in your pocket!

App Store Google Play

FREE download for iPhone, iPad and Android



START-STOP BATTERY

REPLACE BATTERY

EXIDE AGM OR EFB BATTERY

CHARGE

EXIDE 12/7 BATTERY CHARGER

A charger with built-in safety features, suitable for standard, Start-Stop AGM/ EFB and GEL batteries.

INSTALL

EXIDE BRT-12 BATTERY REPLACEMENT TOOL

Most Start-Stop battery replacements do not require special tools

For occasional reset of the Car Management System, Exide's BRT-12 is an affordable, easy-to-use tool.

Unique QR codes on battery labels and mobile product pages provide full product information, including features, benefits and specifications. Please check out www.exide.info

EXIDE EBT-965P NEXT-GENERATION ELECTRONIC BATTERY TESTER

With the EBT965P, Exide supports workshops and dealers in their daily activities, offering a tool that enhances business potential and strengthens trust between customers and workshops.

It can be difficult to keep up with the complexity of modern vehicles. It is also a challenge to keep customers happy and win new business in an increasingly complicated and competitive marketplace.

The technology in new vehicles is changing rapidly – especially in cars, with more demands made by fuel economy, comfort, navigation, safety and entertainment. Battery technologies are also evolving rapidly, following trends around emission reduction and technical development (e.g. Start-Stop).

We know that unexpected battery failure – even when cranking capability is still operational – leads to extra costs for both fleet owners (e.g. missing deliveries) and car drivers, through roadside assistance, emergency battery purchase, replacement labour and overall inconvenience.

Therefore, to ensure that the battery is working well, we need to assess more than just the cranking capability. Exide's next-generation EBT965P battery tester is designed to be quicker, more comprehensive, and more accurate*.

With the latest Conductance Profiling™, EBT965P enables "preventive maintenance". Thanks to its cutting-edge technology, it can predict battery malfunctions even when cranking capability is still operational. This expands the results to include the battery's state of health and its capability to handle demanding energy consumption. Most testers can indicate if a battery is good enough to crank the engine – but they fail to show how well it can cope with the vehicle's electrical loads.

The EBT965P tester can handle every battery technology you are likely to come across, including AGM, EFB and GEL up to 3000A.

Market-first EBTP Exide Battery Tester Programme

Another groundbreaking feature of the EBT965P tester is the ability to link directly to the unique EBTP PWA (Progressive Web Application) developed with Exide expertise. This free, fast and easy-to use web-based application supports the whole battery testing and replacement process.

By scanning for quick battery selection and sharing test data directly with customers, the EBTP web application proposes replacement options, if necessary, by SMS or e-mail, without any waste of time for end-users. The advanced internal algorithm can also suggest when the battery should be tested again, according to the user's driving style. It's available in 13 languages and more than 20 countries, and offers plate-number search in 11 countries.

Batteries can now be tested and replaced in less than 5 minutes!

Discover the EBTP here **https://ebtp.exide.com/**

*Midtronics research

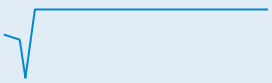
ADDITIONAL FEATURES OF EXIDE EBT965P

- Integrated printer
- Replaceable clamps/leads
- Temperature sensor
- Temperature compensation
- Reverse polarity detection
- Surface charge detection and removal procedure
- 3.5" colour screen
- Service app user interface
- Software in 19 languages

STANDARD TESTERS

Conductance

Cranking Capability CCA



EXIDE EBT-965P TESTER

Conductance Profiling™

Energy Availability START STOP CCA

WHAT IS CONDUCTANCE?

Conductance is how well a material carries an electrical current. The conductance test is a 10-second static test to measure the battery's internal resistance, determining the health of its active material and connections. Basically it estimates the battery's cranking capability (CCA).

WHAT IS CONDUCTANCE PROFILING™ ?

Conductance Profiling™ technology measures the voltage drops under a small discharge load for 1 minute. It compares the battery's response with profiles of batteries with "energy availability" issues, in order to diagnose if the battery can supply electrical charge for a long time.

WHY CONDUCTANCE PROFILING™ ?

Conductance Profiling™ technology does not just estimate the battery's CCA performance. Identifying both cranking ability and energy availability is crucial for vehicles with high electrical requirements. Whilst a battery can start the vehicle, available energy can diminish without the driver noticing. This could cause a problem later especially with Start-Stop vehicles.

BATTERY CHARGERS FOR WORKSHOPS AND END-USERS

Battery chargers are an essential tool for every workshop, as well as for end-users who own seasonal vehicles like vintage cars, motorhomes, caravans, boats or motorcycles.

Apart from regions where cold-weather cranking is a common issue, most car owners do not possess their own charger. For owners of any vehicle that may remain inactive for prolonged periods or those that incorporate a supply battery application, a charger becomes a real necessity. There are many occasions when a battery benefits from a full charge, including just before you put your vehicle into storage for an extended period of time.

In a typical workshop environment, there might be one main workshop charger used for high-end luxury and performance sports cars. This is often supplemented by a number of portable chargers, for routine charging and preservation of power input (Power Mode) when the battery is disconnected for electrical work. Portability is important when the car is moved out of the busy workshop area after the service is complete.

Exide wants its customers to get the longest possible life from their battery, so the company offers a range of chargers with optimised charging profiles. These have individual modes for all battery types, including AGM, EFB and GEL. Exide chargers are not limited to one battery manufacturer, and cover all lead-acid batteries in the automotive market.

EXIDE FUTURE-PROOF CHARGERS WITH SPECIFIC MODES FOR ALL FLOODED, AGM, EFB AND GEL BATTERIES

Vintage vehicle owners and seasonal users are more likely to need their own charger

CHARGING TIPS

- Batteries should be charged off-vehicle if the voltage drops below 12.5 volts (or 6.2 volts for 6V batteries)
- Use the specially developed Exide charger for best results
- Avoid fire or flame and ensure good ventilation during and after charging
- Allow the battery to rest for at least 12 hours after charging

LONGER LIFE BATTERIES FOR HEAVY-DUTY COMMERCIAL VEHICLES

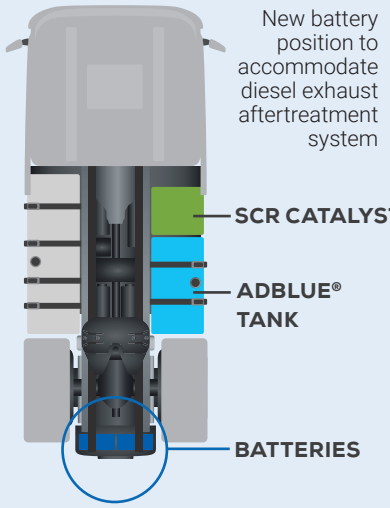
One of the most recent advances in commercial vehicle battery technology has been HVR® (High Vibration Resistance), developed by Exide Technologies. This feature offers unprecedented levels of reliability by substantially absorbing vibration that is the main cause of damage to the internal structure of the battery.

As an important OE partner to major truck manufacturers, Exide developed the HVR® battery to solve a problem created by the introduction of new exhaust after-treatment equipment, required to meet EU regulations for reducing emissions of nitrogen oxides and particulate matter.

The addition of the sizable new SCR catalyst and AdBlue® tank has, in some cases, displaced batteries from the central chassis to a much more vulnerable rear chassis location, where increased vibrations would reduce the lifespan of the product. Exide HVR® batteries limit the effects of vibrations, and provide the performance and life expectancy the vehicle operator demands and expects.

There are many different situations whereExide HVR® offers greater durability and the longest possible battery life. This technology is particularly valuable when used in construction, agriculture/forestry, or in regions with poor road conditions and harsh environments.

Exide's commercial batteries also feature a sealed lid design that offers a number of benefits including safer spark- and spill-proof handling.



A modern commercial vehicle is a large investment. Companies making such a major purchase need to ensure that their vehicles are kept on the road as much as possible. Unforeseen breakdowns and servicing delays can have expensive consequences for the vehicle owner, so it is essential to only fit the best 'original part' replacement.

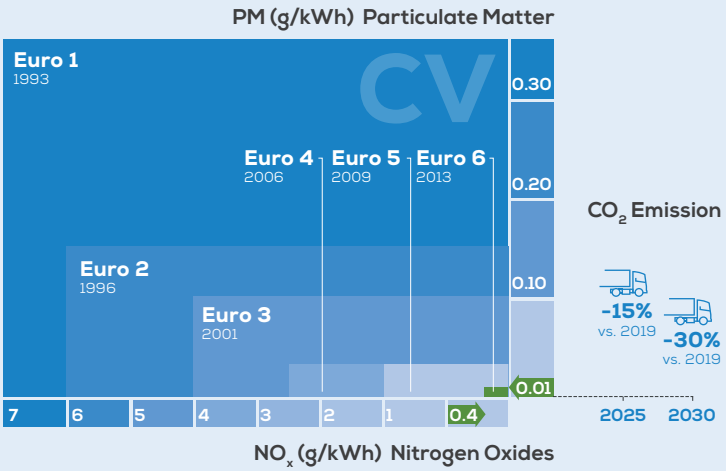
Exide's commercial vehicle batteries are amongst the most powerful on the market and HVR® technology helps the batteries go the distance.

The prime objectives when selecting CV batteries are keeping revenue-making vehicles on the road and reduce TCO Total Cost of Ownership.

EUROPEAN EMISSION STANDARDS
FOR TRUCKS AND BUSES

This table summarises the emission standards and their implementation dates for new type approvals.

A different set of standards apply to passenger cars and light commercial vehicles (pls also refer to p. 17).



The Cost of High Emissions for Fleet Operators

- Higher Fuel Costs
- Higher Road Taxes
- Higher Toll & Parking Charges
- Higher charges to enter Low Emission Zones

These are the key economic factors driving operators to upgrade their fleets by purchasing new Euro5/6 vehicles, fitting new engines or approved filter systems.

European Low-Emission Zones (LEZ)

As of 2019, around 250 cities and towns in twelve countries across Europe, operate or are preparing to introduce Low-Emission Zones (LEZ's) to help meet EU health-based air quality limit values.

Restrictions are applied mainly to older diesel-engine trucks and buses, but increasingly diesel cars too. This means that vehicles may be banned from a LEZ, or a charge is made to enter the zone when emissions exceed a predefined level.

Example: Greater London - the largest LEZ in the world. Daily charge over €220* for a truck over 3.5 tons gross weight.

London Ultra Low-Emission Zones (ULEZ)

Introduced in 2019 all trucks and buses within a separate ULEZ must meet or exceed Euro 6 standard or pay €110*. Enlargement of zones and tougher emission standards are planned for 2021.

*Approx. exchange rate June 2020. Source: Transport for London

MAIN FACTORS
WHEN SELECTING THE RIGHT BATTERY FOR CV APPLICATIONS

Logistics is more important than ever, with customers expecting faster and more predictable deliveries. In this competitive environment, fleet owners are focusing on reliability and total cost of ownership. Indeed, when a truck is off the road, it leads to customer dissatisfaction, unused labour and capital and potential fines or penalties.

Exide designed its battery range for superior performance and to reduce the risk of breakdowns due to non-starting. As a true expert in OE batteries, Exide helps you select the right battery. For fleet owners and installers alike, it is vital to make the right choice for the conditions of use. Three important criteria to consider in battery performance are: vibration resistance, cycling endurance and cranking power.

VIBRATION RESISTANCE

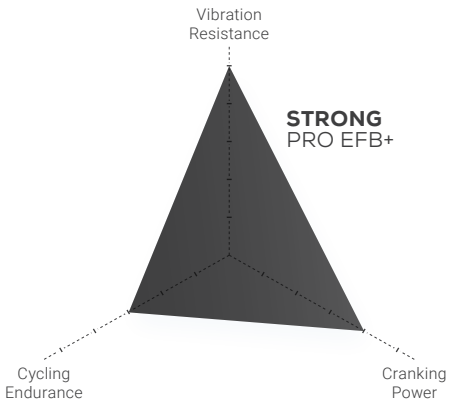
For trucks with rear-chassis battery installations (e.g. Euro 5/ Euro 6 trucks), robust and high-vibration-resistant batteries are mandatory to avoid breakdowns. Vibration resistance is also required for any vehicle operating on bad roads or rough terrain.

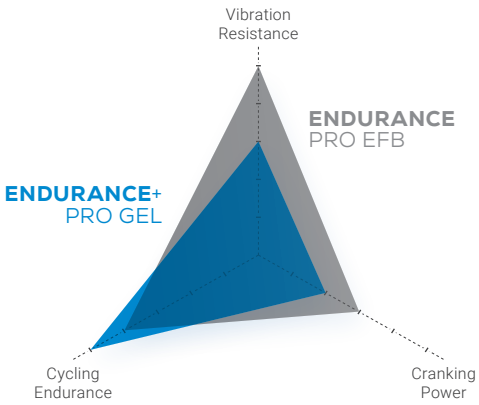
CYCLING ENDURANCE

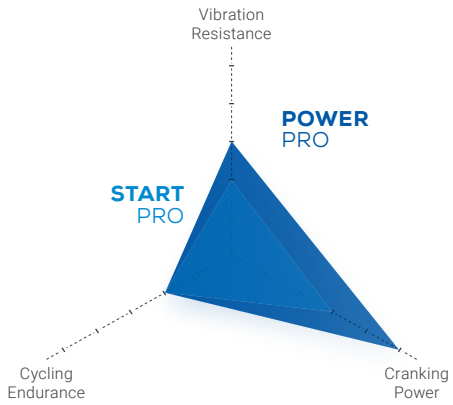
High cycling endurance is important for long-haul trucks with life on-board, commercial vehicles doing intensive urban deliveries, and any commercial vehicle with extensive energy requirements. This maximizes battery lifespan and ensures a safe battery start.

CRANKING POWER

High cranking power allows for engine starts in cold climates and is required for many power-intensive vehicles in agriculture and construction.



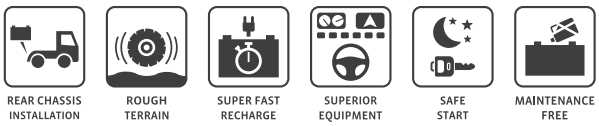




EXIDE STRONGPRO EFB+

Exide's StrongPRO battery range is now stronger than ever. A new carbon-based formula of negative active mass enhances the recharge-ability and charge acceptance of StrongPRO EFB+ battery. Additionally, the HVR® (high-vibration-resistant) technology enables StrongPRO EFB+ to pass the extreme vibration tests under the latest European V4 standard.

A more robust and more lasting battery means reduced total service cost for fleet owners and truck drivers, allowing less replacements over vehicle's service life and minimized risk of unexpected and premature battery failure.



Benefits

- Better rechargeability and charge acceptance than previous generation StrongPRO
- Better control over gassing and stronger anti-stratification effect
- Extremely robust – with HVR® technology, meeting V4 requirements
- Up to 70% savings on TCO within 2 years period when compared with standard batteries
- Maximum starting reliability after overnight stay
- OE experience inside
- First class safety features
- Maintenance free - no topping up

SPARE ORIGINAL PART

REINFORCED CONTAINER
wall with additional ribs*

LABYRINTH INTEGRATED
into the lid with flame arrestor and central degassing outlet for maximum safety

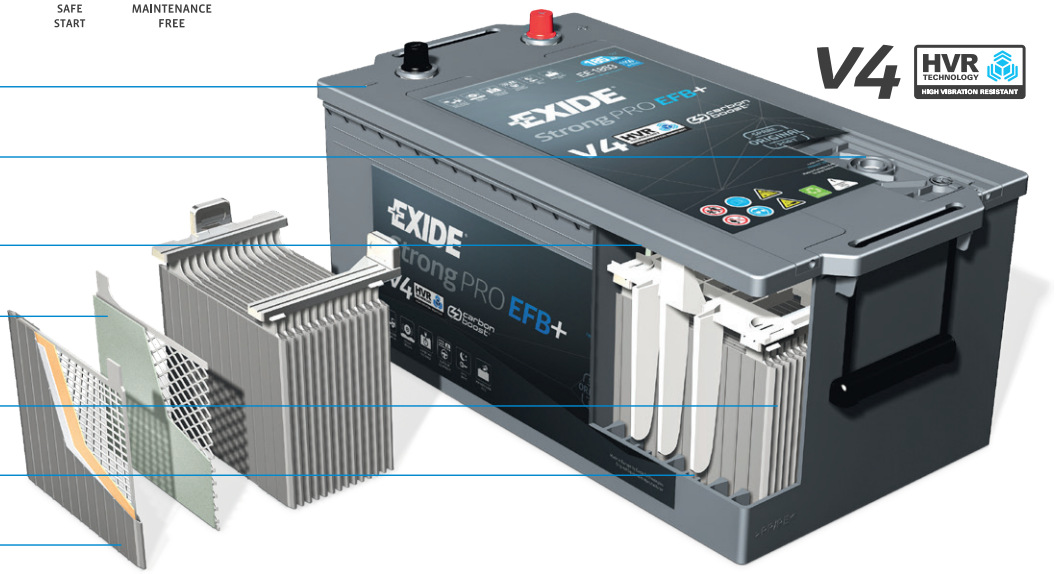
ADDITIONAL HOT MELT
spots locking the cell group*

3DX NEGATIVE GRIDS
with Carbon Boost® for super-fast recharge and improved cycling

NEW EXTENDED SIDE
and top fixation*

BOTTOM PLATE
adhesion for extra fixation*

FRAMED POSITIVE GRIDS
with heavy-duty polyethylene separator and glass mat for homogeneous compression



*Latest generation of Exide's leading HVR® design, meeting V4 requirements (EN 50342-1:2015)

RECOMMENDED TYPE OF VEHICLES / USE CONDITIONS:

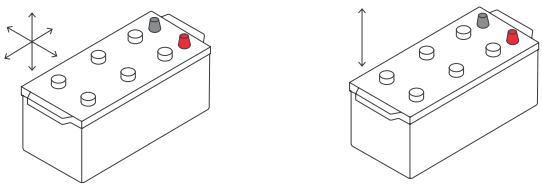
Long-haul modern/ standard trucks with rear chassis installations and/or «hotel functions», express delivery and city bus.

EN50342-1 STANDARD: V4 TEST MUCH TOUGHER

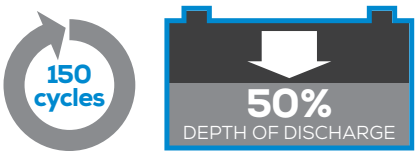
Even more demanding than OE customer specifications

- **The last edition of the European standard was officially released in 2018:** Superseding the 2015 edition.
- **V4 vibration test:** A more rigorous test based on 3 axis motion simulates 'real life' conditions. V1-3 tests were based on single axis vibration only.
- **Endurance test:** The current E2 test replaced the previous E4 test for standard lead-acid batteries. This level is more demanding, requiring test batteries to complete at least 150 cycles (at 50% DoD) without any intermediate full recharge.
- **Exide meets the challenge:** Exide's R&D team has worked hard to make the best even better, by developing a completely new HVR® product. Exide was one of the first battery manufacturer to meet the highest V4 standard.

CURRENT THREE AXIS TEST **PREVIOUS SINGLE AXIS TEST**



CURRENT ENDURANCE TEST



EXIDE ENDURANCE+PRO GEL

Available in D06 box

VRLA

EQUIPMENT ORIGINAL MANUFACTURER

ORIGINAL GEL | EXTREME CYCLING | SAFE START | URBAN DELIVERY | MAINTENANCE FREE | HIGH ENERGY DENSITY

Exide Technologies is the inventor of Gel technology, the ultimate choice for the most demanding commercial vehicles applications.

Instead of being in liquid form, the electrolyte is fixed in a gel. This leads to unmatchable cycle life. The new Exide Endurance+PRO GEL battery is highly robust, with best-in-class deep cycle properties. It allows unmatched safe depth of discharge of 90%, which improves Total Cost of Ownership (TCO) and minimizes the risk of breakdowns.

Benefits

- **Impressive energy throughput over the battery lifetime:** safe DoD of 90%, vs 50% of standard flooded batteries, and 5 times more cycles than a comparable standard flooded battery
- Withstands deep discharges for maximum reliability
- Valve regulated: maximum safety and highly vibration resistant
- Very low self discharge
- Maintenance free
- Designed for OE applications

LONG-HAUL
With 'hotel loads' comfort equipment

URBAN TRANSPORT
With information & security systems

DELIVERY TRUCKS
With electric lifts/loaders

SPECIAL VEHICLES
With heavy power equipment

MORE INFORMATION

The new Endurance+PRO GEL battery is the most effective and efficient option compared to any other VRLA battery. In fact, it passes 1000 cycles EN 50% DoD test and has 90% safe DoD (compared to 75% of any other VRLA battery), which means more energy available over time, leading to a minimized TCO.

EXIDE ENDURANCEPRO EFB

Requires water topping

V4 HVR TECHNOLOGY HIGH VIBRATION RESISTANT

SPARE ORIGINAL PART

SUPERIOR CYCLING | SUPERIOR EQUIPMENT | SAFE START | URBAN DELIVERY | LOW MAINTENANCE

GLASS MAT SHD TECHNOLOGY

Exide's EndurancePRO range evolves: the "made for severe cycling" battery range features the innovative HVR® (High Vibration Resistance) design, that assures an incomparable level of robustness and minimized risk of unexpected and premature battery failure. Not only it guarantees excellent cycling performances and reduced stratification: the new EndurancePRO EFB battery now exceed the highest requirements in the industry's reference vibration test (V4 level in EN50342-1 vibration test) and it is perfectly adapted to be installed into vehicles running on rough terrain.

All this means less risk of breakdowns, more starting reliability and longer lifespan.

Benefits

- Extremely robust – Now with HVR® technology, meeting V4 requirements
- Perfect for deep cycling applications : 2x more cycle life compared to standard truck battery (advanced SHD technology with glass matt layers pasted on active mass) allowing excellent cycling performance (up to 200 cycles at 50% DoD)
- Improved durability
- OE experience inside

RECOMMENDED TYPE OF VEHICLES / USE CONDITIONS:

Long-haul modern/standard trucks with rear chassis installations and/or hotel functions. Ideal for vehicle running on rough terrain.

POWERPRO

RECOMMENDED TYPE OF VEHICLES / USE CONDITIONS:

Standard trucks or vehicles with large/highly compressed engine working in extreme climate and/or high CCA requirements.

Benefits

- Superior cranking power (more plates and active material to maximize grid surface)
- Robust and reliable design with hot melt fixation of plate groups
- Maintenance free - no topping up
- OE experience inside

SUPERIOR POWER | COLD TEMPERATURE | MAINTENANCE FREE | HDX TECHNOLOGY

POWERPRO

AGRI & CONSTRUCTION

RECOMMENDED TYPE OF VEHICLES / USE CONDITIONS:

Tractors and construction machines (agriculture, forestry and construction machinery)

Benefits

- Superior cranking power (more plates and active material to maximize grid surface)
- Robust design with hot melt fixation of plate groups
- Wide range including special types
- True OE design and construction (original part)
- Maintenance Free - no topping up

TRUE OE AGRI FIT | TRUE OE CONSTRUCTION FIT | SUPERIOR POWER | MAINTENANCE FREE

SPARE ORIGINAL PART

STARTPRO

RECOMMENDED TYPE OF VEHICLES / USE CONDITIONS:

Strandard truck without specific vibration, cycling or cranking needs.

Benefits

- Ideal for trucks without special requirements in terms of vibration resistance, cycling or cranking power
- Robust and reliable design with hot melt fixation of plate groups
- Complete range covering almost 100% of vehicle parc, including special types
- Low maintenance - may need water topping up

LOW MAINTENANCE | HD TECHNOLOGY

DUAL BATTERY SYSTEM
INFOGRAPHIC ON NEXT PAGE ›

EXIDE DUAL BATTERY SYSTEM ORIGINALLY DESIGNED FOR SCANIA, NOW ADOPTED BY OTHER LEADING TRUCK MANUFACTURERS

The Dual Battery System was developed by Exide Technologies in association with its customer Scania, for intensive truck use and as the ultimate solution for reliable starting.

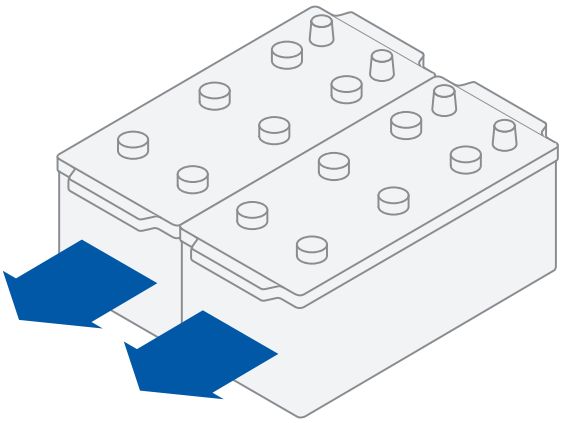
In contrast to the classic layout – two standard flooded truck batteries providing energy for both engine start and supply functions – the Dual Battery System includes two Orbital AGM batteries for cranking the engine at start-up, plus two GEL batteries for on-board power supply. This optimised technology matches the best battery type with each specific function. The Orbital AGM batteries supply full power to crank the engine and then restore a full charge before switching off. When the engine is off, power is provided exclusively by the GEL batteries, which ensures the Orbital AGM batteries remain fully charged for the next engine start.

The benefits of the Dual Battery System are clear. The first advantage is improved starting reliability, as the power in the Orbital AGM units is reserved solely for starting the engine.

This means reduced truck downtime, as these batteries are always ready. The GEL batteries provide a better power supply for devices such as the heater, television, fridge, etc. – items which need to run during the night, when the vehicle is off the road. Another advantage is the weight saved in comparison with conventional batteries, leading to reduced fuel consumption. The dimensions of the Dual Battery System are the same as the classic system, so there is no impact on housing them in the vehicle.

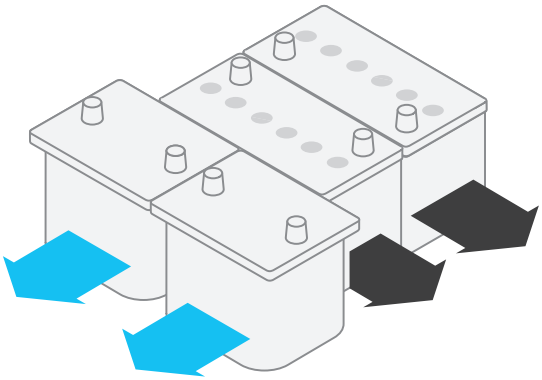
The Dual Battery System was first successfully integrated into the Scania Streamliner truck range followed by similar Exide dual configurations with other major truck manufacturers.

TRADITIONAL TRUCK BATTERY CONFIGURATION



CONVENTIONAL FLOODED START AND SUPPLY

EXIDE DUAL BATTERY SYSTEM

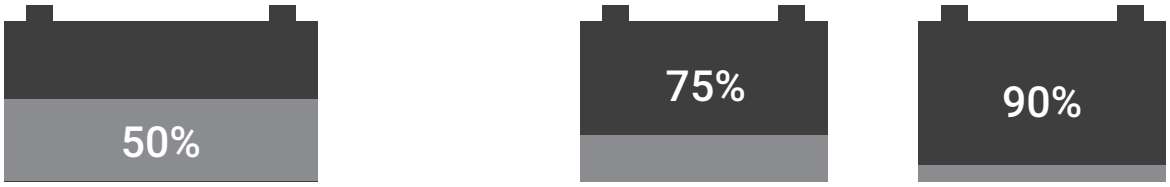


ORBITAL AGM START

GEL SUPPLY

SAFE LEVEL OF DISCHARGE

Recommended limits for optimum battery life*



In normal day-to-day situations, the traditional configuration of heavy-duty batteries providing both start and supply functions continues to serve vehicle operators well. Experienced drivers are aware of and respect the limits of on-board power.

Exide's Dual Battery System copes far better with any unscheduled delay in transit. The GEL battery set offers deeper discharge to supply power when the engine is off, while the independent Orbital AGM set remains fresh and ready to provide reliable starting power.

BENEFITS OF EACH BATTERY TYPE

CONVENTIONAL FLOODED

- Standard configuration
- Lower initial cost

ORBITAL AGM START

- Faster recharge
- More reliable starting
- Longer battery life

GEL SUPPLY

- Greater supply capacity
- Extended periods between recharge
- Longer battery life

*Calculations based on an average battery life of 300 cycles and depth of discharge at 20º C.

Beyond these recommended levels: Deeper discharge = shorter average life. Shallower discharge = longer average life.

GEL IS THE IDEAL CHOICE OF BATTERY AS A RELIABLE SECONDARY POWER SUPPLY FOR ANY VEHICLE WITH ESSENTIAL ON-BOARD EQUIPMENT

Emergency vehicles carrying pumps, winches and electrical rescue equipment

Urban buses with extensive use of Closed-Circuit Television security and passenger information systems

Mobile cranes, power lifts and all specialist task vehicles

EXIDE MOTORBIKE & SPORT BATTERIES

READY TO USE
OR FAST FILL

Although commonly known as bike batteries, we use the same technology for jet skis, snowmobiles, quad bikes, golf carts and lawn mowers. With the exception of snowmobiles, most of these vehicles are used much more frequently during the spring and summer months. This means the batteries need to be able to handle long periods without being used.

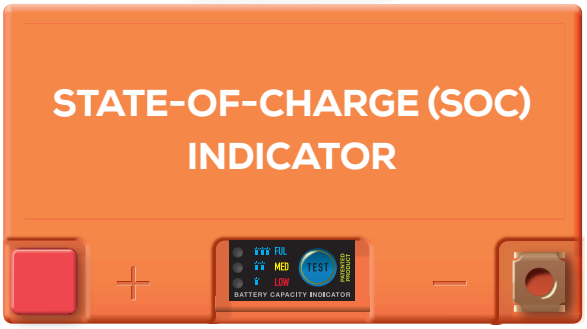
In this market segment, some owners can be very passionate about their machines and often prefer to self-fit their battery. For this reason, Exide has developed a wide range of Motorbike & Sport battery options including dry charged with easy-filling acid packs.

EXIDE LI-ION

Exide's lithium-ion Motorbike & Sport battery range is offered to those who demand the ultimate riding experience. The battery's ultra-lightweight design reduces the overall weight of the bike, enabling faster acceleration and better performance. It has very low self-discharge, which is ideal for engine starting after long periods off the road.

Exide Li-ion Features and Benefits

- Ultra-lightweight – up to 80% lighter than lead-acid batteries
- Very low self-discharge – long shelf life and perfect for seasonal use
- Super-fast recharging
- Extreme cycle life – more than 2000 cycles
- First-class safety features
- Multi-position mounting – even upside down
- Ready to use and maintenance free – just install and forget
- State-of-charge indicator for regular checks at one glance
- Covers the majority of parc – spacers included for more fitment possibilities



3 LIGHTS
Battery is fully charged

2 LIGHTS
Battery can still perform cranking, but recharge is recommended
SoC ≈30%
OCV ≈ 13.05V

1 LIGHTS
Battery needs to be recharged
SoC ≈ 10%
OCV≈ 12.9V

IMPORTANT
ALL LI-ION BATTERIES REQUIRE A SPECIAL DEDICATED CHARGER

Exide Li-ion Battery Charger
See page 38

EXIDE MOTORBIKE & SPORT BATTERIES

Factory-sealed and ready-to-use

Exide Li-Ion, GEL and AGM Ready are charged and ready-to-use straight out of the box. GEL and AGM Ready are pre-filled with acid (Li-Ion does not require acid) for quick and easy installation and maintenance-free operation.

The GEL version features technology originally invented by Sonnenschein®, now part of Exide. The battery provides maximum cycle life and deep-discharge protection, ideal for vehicles with power-hungry electrical equipment. The AGM Ready battery offers the highest power and extended cycle life. All batteries in this catagory are spill-/leak-proof and highly vibration resistant, ideal for high-class motorcycles, powersport and off-road vehicles.

Dry Charged with 'easy-fill' acid pack supplied

This AGM battery comes in dry form. This has obvious advantages for shelf life, as the life cycle of the battery does not begin until it is filled and charged. After installation the battery is maintenance free. This battery offers impressive performance and is suitable for most applications. The design is leak-proof and vibration resistant, but not recommended for side mounting. A six-pack acid bottle is included which allows the user or stockist to quickly fill the battery with precise quantities of acid.

Conventional flooded batteries remain a popular choice for entry-level and older vehicles with standard power needs. Acid filling is required, using Exide's simplified and easy acid filling process. Conventional batteries are supplied with cell plugs that need to be fitted before installation and reopened for occasional water topping up.

Exide is a premium sponsor of the Intact GP racing team for the 2019 & 2020 Moto2 seasons

	LI-ION
PERFORMANCES	Ultra lightweight Extreme cycle life Highly vibration resistant Very low self-discharge
RECOMMENDED VEHICLE PARC	Ultimate choice for sport bikes
RECOMMENDED APPLICATIONS	
MAINTENANCE	MAINTENANCE FREE
INCLINATION LEVEL	MULTIPLE POSITIONS
HERMETIC SEAL	HERMETIC SEAL
READY TO USE	READY TO USE
ACID PACK INCLUDED	No acid
TECHNOLOGY	Lithium-ion

ULTRA LIGHT WEIGHT | EXTREME CYCLE LIFE | FAST RECHARGE

SPARE ORIGINAL PART

PERFECT FOR SEASONAL USE

MATCHING QUALITY PART

GEL	AGM READY	AGM	CONVENTIONAL
Superior capacity Maximum safety Maximum cycle life Highly vibration resistant Deep-discharge protection	Superior power Ultra safe features Extended cycle life Highly vibration resistant	Superior power Great safety features Extended cycle life Vibration resistant	Good power Good cycle life
Ideal for premium vehicles with built-in or add-on electrical equipment	Ideal for high-class motorcycles, powersport and off-road vehicles	Fits most applications	Suitable for standard power needs
MAINTENANCE FREE	MAINTENANCE FREE	MAINTENANCE FREE	Could require water refilling
HIGHT INCLINATION	HIGHT INCLINATION	MEDIUM INCLINATION	Upright mounting only
HERMETIC SEAL	HERMETIC SEAL	HERMETIC SEAL*	
READY TO USE	READY TO USE	Initial filling required	Initial filling required
No initial filling	No initial filling	ACID PACK INCLUDED	ACID PACK INCLUDED
Gel	AGM charged	AGM dry charged	Flooded dry charged

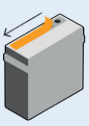
ORIGINAL GEL

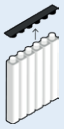
SUPERIOR EQUIPMENT

* Becomes sealed after initial filling

AGM & CONVENTIONAL
ACID FILLING INSTRUCTIONS

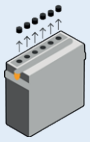
1 PREPARE





AGM

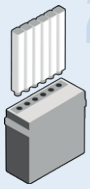
Remove the red protective seal from the battery. Remove the lid from the acid pack, keeping the lid and not piercing or peeling the seal.



CONVENTIONAL

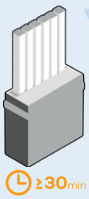
Remove the plugs from the battery cell openings on the top and set aside. Remove the red exhaust cap on the side and discard. Do not pierce or peel the seal on the acid pack.*

2 ALIGN



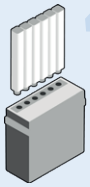
Align the acid pack with the battery cell openings.

3 FILL



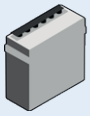
Press the acid pack gently downward until the seal is self-punctured. The acid will flow into the battery cells. Wait until the acid is fully filled and let the battery rest for at least 30 minutes.

4 DISPOSE



Gently rock the acid pack to make sure all acid is dispensed. Carefully remove the acid pack and dispose of safely. Wipe off any spilled acid from the battery.

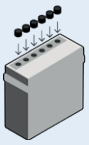
5 COVER



Lid from acid pack

AGM

Cover the battery cell openings carefully and firmly with the lid you removed from the acid bottle pack.



CONVENTIONAL

Put the plugs back on the battery cell carefully and firmly.

Batteries should be handled properly.
Please always refer to the instruction booklet supplied with each battery.

* Some Conventional batteries come with a single-bottle acid pack.

ACCESSORIES FOR MOTORBIKE & SPORTS BATTERIES

Motorcycles and powersport vehicles often go extended periods without being used, but this does not have to be a problem. Follow the tips below and your engine will start just fine, even after a long winter stored away. Exide also has a range of chargers and testers, designed for the home or workshop. With the right maintenance, your battery will last even longer.

CHARGING

BATTERY CHARGER

Exide chargers can be used for a wide range of vehicle and lead-acid battery types. They are fully automatic and have a built-in temperature compensator, which is especially useful in cold climates. The chargers ensure optimum charging, can be used for batteries from 1 Ah up to 300 Ah, and have integrated safety functions to identify if anything is wrong with the battery.

CONVENTIONAL | AGM | EFB | GEL

CHARGING TIPS

- Batteries should be charged off-vehicle if the voltage drops below 12.5 volts (or 6.2 volts for 6V batteries)
- Use the specially-developed Exide motorcycle charger for best results
- Avoid fire or flame and ensure good ventilation during and after charging
- Allow the battery to rest for at least 12 hours after charging

12/2 LI-ION

INTELLIGENT LI-ION BATTERY CHARGER

Li-Ion batteries require special chargers with charging profiles adapted for this technology. Do not use a lead-acid battery charger which will damage the battery. Exide 12/2 Li-Ion charger is created specifically for Exide Li-Ion Motorbike & Sport batteries, bringing extended battery service life and maximum safety.

LI-ION

Open-circuit voltage (abbreviated as OCV) is the difference of electrical potential between two terminals of a device when disconnected from any circuit.

SUPPLY BATTERIES
FOR MARINE AND LEISURE

Supply batteries are sometimes referred to as deep-cycle batteries or leisure/multi-fit batteries. They are commonly used in motorhomes, caravans and boats to provide stored electricity in remote locations without access to a campsite's or marina's main power connection.

Choosing the right supply battery is subject to more variables than with a starter battery. A car battery, for example, is relatively straightforward, simply matching the battery specification to the correct car model, engine and year. Supply batteries are not defined by the vehicle or vessel itself, but by how the owner uses his on-board power supply. Basically, the amount of electrical energy consumed and the length of periods away from a recharging point determine the right choice. Not having enough stored energy is inconvenient at best. In the case of a boat at sea, it could be life-threatening if navigation and communication systems are unavailable.

Starter batteries are made with thinner plates allowing more plates to be fitted in each cell. This is necessary to deliver better Cold Cranking Amperes (CCA) performances, essential for quick bursts of high energy to crank the engine. Supply batteries are designed with thicker plates that provide a deeper and longer discharge. To use a sporting analogy, think of the starter battery as a sprinter and the supply battery as a marathon runner.

Exide Technologies has a well-established reputation in the marine and leisure markets. As an OE manufacturer, the company also supplies a wide range of quality aftermarket batteries to meet individual users' needs. Exide Dual and Dual AGM are multi-function batteries that support engine cranking and supply-power requirements. Whilst Exide Dual is a very popular choice for light to medium users, the AGM variant offers the fastest recharge of any supply battery type. Exide's Equipment GEL is the ultimate supply battery, offering excellent power to weight efficiency and, as a result, the best fuel efficiency. Lastly, the new Equipment Li-Ion battery, that offers super fast recharge (battery can be fully recharged in about 2 hours), very low self discharge and up to 50% lower weight compared to standard batteries.

A unique advantage of Exide supply batteries to resellers and end-users is the specification and labelling in Wh (watt-hours) rather than the Ah (amp-hours) traditionally favoured by other manufacturers. This greatly simplifies calculation of the on-board electrical equipment and its typical daily usage. For example, a 25 watt lamp switched on for 4 hours equals 100Wh. By adding up the watt-hours of all the devices used between recharging, and adding a recommended safety margin of 20%, it is quite easy to find the right combination of one or more Exide batteries to meet your power needs. See the example shown in the 'Supply needs calculator' on the next page to understand how it works.

A SIGNIFICANT MARKET
IN EUROPE THERE ARE...

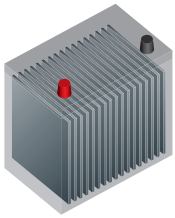
5.4 MILLION
leisure vehicles*

5.7 MILLION
recreational boats*

Detailed aftermarket facts and figures available on pages 56/57

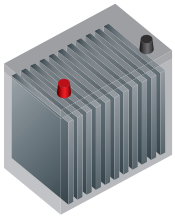
*Source: European Caravan Federation (2018) & International Boat Industry (2015)

SUPPLY BATTERY OPTIONS
AND ENERGY-NEEDS FORMULA



STARTER BATTERY

Thinner plates allow for more plates in the battery. Better for short bursts of high energy needed for starting.



SUPPLY (DEEP CYCLE) BATTERIES

Thicker plates improve the cyclability for deeper and longer discharge.

		Start	Start + plus equipment load	Equipment load only
			Available as: Dual, Dual AGM or Dual EFB for starting and supply needs	Available as: Equipment, Equipment AGM, Equipment GEL or Equipment Li-Ion for greater Depth of Discharge
Car		SLI		
Caravan			Cabin lighting and appliances	Lighting and appliances
Motorhome		SLI	Engine cranking plus cabin lighting and appliances	Lighting and appliances
Boat		SLI	Engine cranking plus cabin lighting and appliances	+ specialist marine equipment

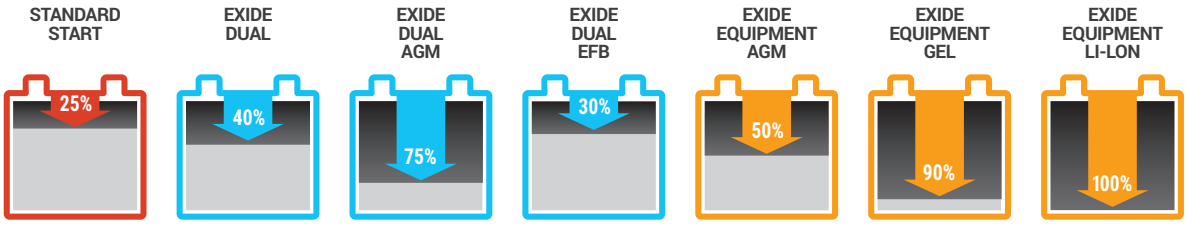
SLI = Starting, Lighting (standard vehicle), and Ignition

Average Life

300+ cycles

based on recommended **Depth of Discharge (DoD)**

RECOMMENDED SAFE LEVELS OF BATTERY DISCHARGE*



Beyond these recommended levels: Deeper discharge = shorter average life. Shallower discharge = longer average life.

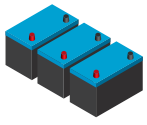
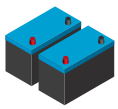
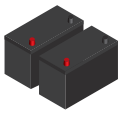
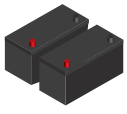
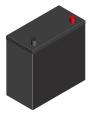
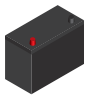
*Estimates based on depth of discharge at 20°C

Supply needs calculator

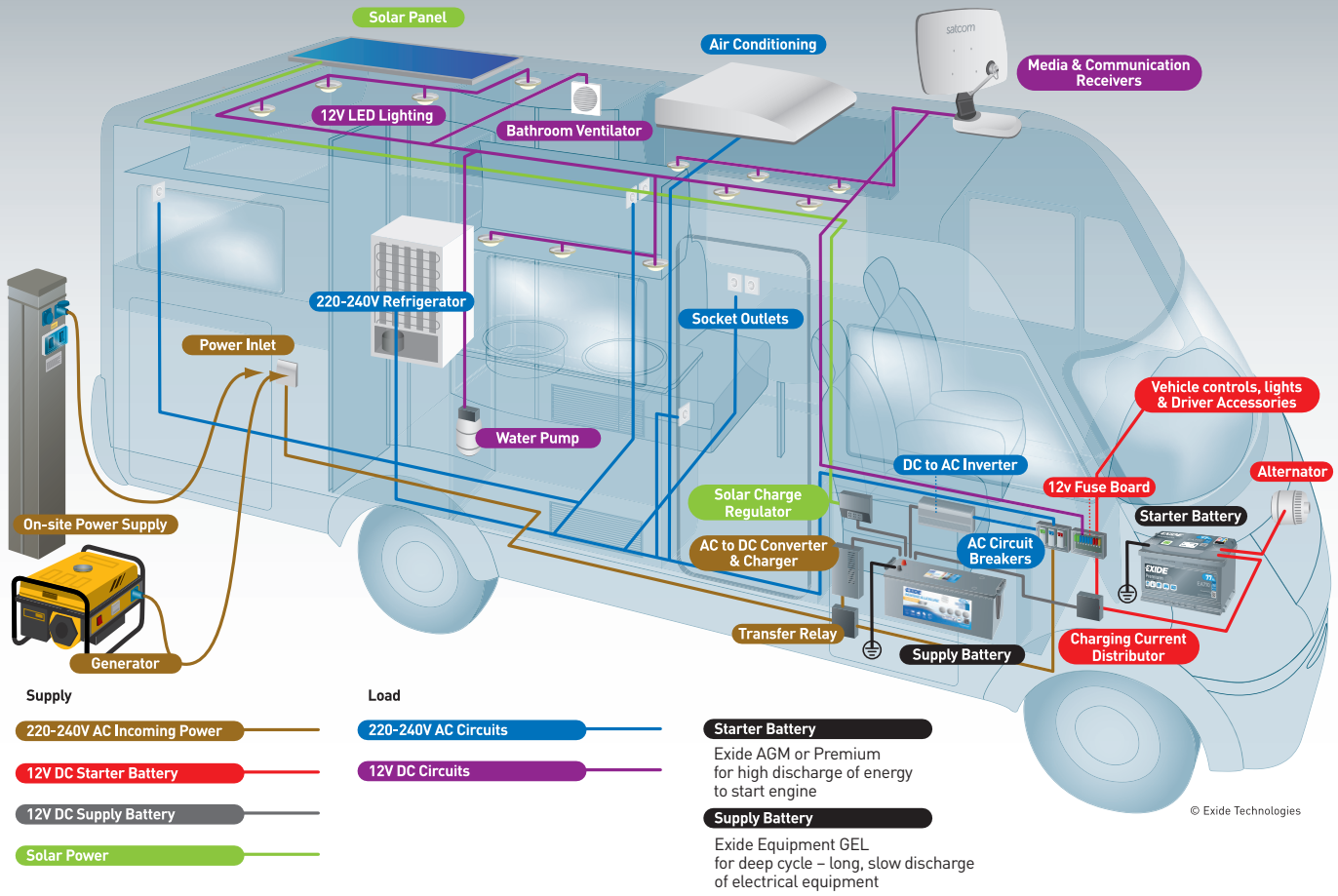
Add up all devices (W) and estimate usage (h) between recharge

W × h = Wh	Watts	hours	Watt hours
	25 × 4 =		100
	300 × 1 =		300
	40 × 3 =		120
	35 × 2 =		70
	80 × 6 =		480
Total devices =			1070
× 1.2 Safety margin +			214
Required Wh =			1284

EXIDE SUPPLY BATTERY OPTIONS

	EXIDE DUAL	EXIDE DUAL AGM	EXIDE DUAL EFB	EXIDE EQUIPMENT AGM	EXIDE EQUIPMENT GEL	EXIDE EQUIPMENT LI-LON
						
	450Wh/95Ah	900Wh/100Ah	850Wh/100Ah	800Wh/95Ah	1300Wh/120Ah	1600Wh/125Ah
Number of batteries and total weight	3 × 23kg = 69kg	2 × 32kg = 64kg	2 × 26kg = 52kg	2 × 26kg = 52kg	1 × 39kg = 39kg	1 × 15kg = 15kg
						
		Fast recharge time	Maximum Charge Acceptance		Smaller volume/ weight ratio	Ultra light-weight with fastest recharge
		DNV GL certification			DNV GL certification	
	1350Wh	1800Wh	1700Wh	1600Wh	1300Wh	1600Wh

The rated energy in Wh is calculated based on the safe DoD indicated above: 100Ah in AGM is equal to 900Wh because of allowed DoD is 75% (otherwise 100Ah at 12V would be 1200Wh)



The motorhome illustration above shows the electrical power needs of a typical leisure vehicle. The starter battery provides a regulated supply of energy for the vehicle's standard electrical devices, but a separate supply battery is installed to deal with the additional loads on the AC and DC circuits.

The major benefit of a supply battery is the depth of discharge between recharging. When the vehicle is in motion, the battery is replenished by sharing energy generated by the alternator. When the engine is off, input energy from an on-site power supply or portable generator (supplemented by solar panels) can be used to rest or recharge the supply battery.

A similar concept applies to caravans without the need for a starter battery and alternator input. In the case of marine applications, the starter and supply batteries follow the same general principle of the motorhome, but there is an ever-increasing trend to prioritise navigation, winching and communication, etc., which can be absolutely critical, especially with sea-going vessels. Larger boats have more on-board electric equipment and generally operate on longer trips between battery recharges. It is not uncommon on these vessels to find a bank of supply batteries configured to provide ample stored energy for the longest voyages.

TYPE APPROVED PRODUCT
DNV·GL
MARITIME

Exide Start AGM, Dual AGM and Equipment GEL batteries are approved by DNV GL for safe and reliable use at sea. This is the highest possible endorsement of a marine market product. Very few lead-acid batteries have passed the vigorous independent tests required to attain this certification. It is an achievement Exide Technologies is extremely proud of.

DNV GL is an independent foundation established in 1864 with the purpose of safeguarding life, property and the environment.

Find out more: www.dnvgl.com

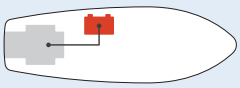
Product registered and VERIFIED www.thencc.org.uk

All Exide leisure batteries are also NCC verified and approved for use in motorhomes and caravans.

Discover our market-first, easy and fast online calculator to assess your energy needs. Discover it here: https://www.exide.com/eu/en/battery-finder/leisure/boat

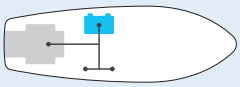
MARINE LEISURE BATTERIES OPTIONS

Case A
Engine only



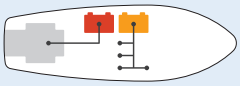
Boats for which batteries are applied to engine start only. The electrical equipment is not supplied with energy when the engine is switched off. This configuration corresponds to Engine start need.

Case B
Engine & Equipment



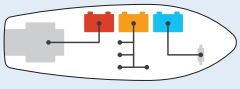
Boats for which one unique bank of battery has to supply power for engine start and electrical equipment. This configuration corresponds to Dual supply need.

Case C
Engine + Equipment



Boats for which 2 separate banks of batteries are dedicated to supply power, one for engine start and the other for electrical equipment. This configuration corresponds to two needs: Engine start plus Equipment supply. In total, 2 different batteries are required.

Case D
Engine + Equipment + Other



Boats for which, in addition to 2 main battery banks (engine + equipment), other batteries are installed to supply power directly to electrical winches, thrusters or trolling motors. This configuration corresponds to three needs: Engine start plus Equipment supply plus Dual supply. In total, 3 different batteries are required.

ENGINE START NEED

START

Standard flooded with plug venting

Benefits

- Superior starting power
- Absolutely maintenance free
- Very low gas emission
- Spark arrestor & central degassing for safe gas conduction
- Slight inclination

Benefits

- Superior starting power
- Up to 50% faster recharging

DUAL SUPPLY NEED

DUAL

Standard flooded with central degassing

Benefits

- Start & supply
- Low maintenance
- Low gas emission
- To be installed in special container
- Upright mount
- Medium vibration & tilt resistant
- Top indicator for electrolyte & charge inspection (except ER660)

DUAL AGM

AGM flat or orbital with VRLA venting

Benefits

- Extra start & supply
- Absolutely maintenance free
- Suitable for long resting periods
- Faster recharge
- Up to 50% faster recharging
- High inclination
- High vibration & tilt resistant
- Internal gas recombination
- No location constraints (cabin safe)
- Safe and clean (spark & spill-proof)

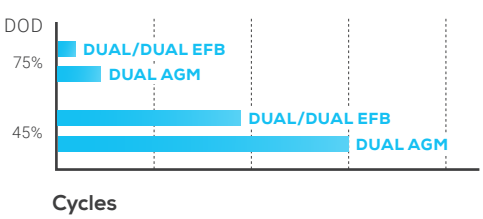
DUAL EFB

Enhanced Flooded Battery

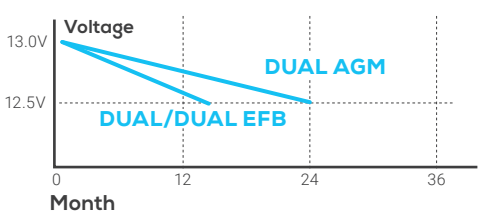
Benefits

- Extra start & supply
- Maintenance free
- Maximum Charge Acceptance

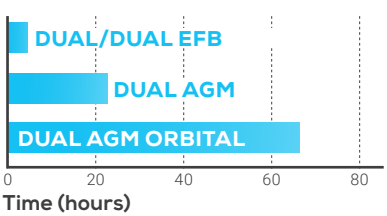
CYCLING PERFORMANCES VS DEPTH OF DISCHARGE AT 20°C



SHELF LIFE AT 20°C



VIBRATION RESISTANCE AT 6G/35HZ (Referred to EN50342)

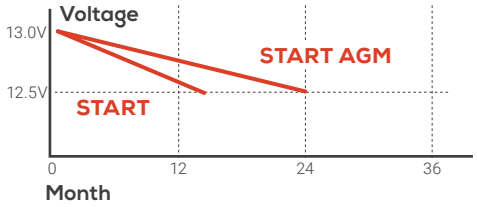


START AGM

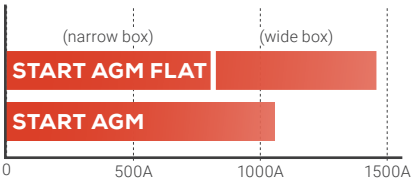
AGM flat or orbital with VRLA venting

- Absolutely maintenance free
- Suitable for long resting periods
- High inclination
- High vibration & tilt resistant
- Internal gas recombination
- No location constraints (cabin safe)
- Safe and clean (spark & spill-proof)

SHELF LIFE AT 20ºC



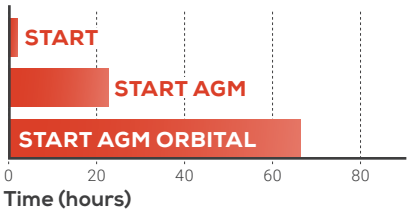
MARINE CRANKING POWER AT 0°C*



* Referred to BCI standard for Marine Cranking Amperes (MCA)

VIBRATION RESISTANCE AT 6G/35HZ

(Referred to EN50342)



EQUIPMENT SUPPLY NEED

EQUIPMENT

Standard flooded with glass mat separators and plug venting.

Benefits

- Superior cycling
- Low maintenance
- Slight inclination
- Medium vibration & tilt resistant

EQUIPMENT AGM

Absorbent Glass Mat

Benefits

- Superior cycling
- Internal gas recombination
- Maintenance free
- Medium inclination
- Faster recharging

EQUIPMENT GEL

Gel (electrolyte fixed in a gel) with VRLA venting.

Benefits

- Superior cycling
- Internal gas recombination
- No location constraints (cabin safe)
- Safe and clean (spark & spill-proof)
- High inclination
- High vibration & tilt resistant
- Absolutely maintenance free
- Suitable for long resting periods
- High energy density
- Space saving of up to 30%

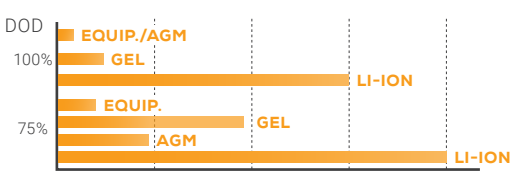
EQUIPMENT LI-ON

Lithium-Ion technology

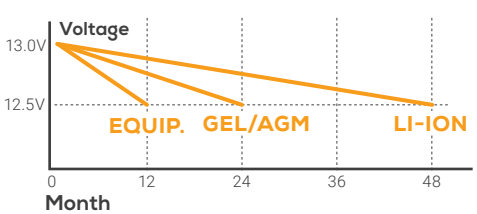
Benefits

- Ultra light weight
- Superior cycling
- Up to 50% faster recharging
- Ready to use
- Multiple positions
- Absolutely maintenance free
- Suitable for long resting periods

CYCLING PERFORMANCES VS DEPTH OF DISCHARGE AT 20°C

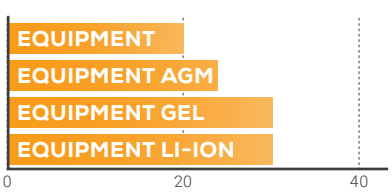


SHELF LIFE AT 20°C



VIBRATION RESISTANCE AT 6G/35HZ

(Referred to EN50342)



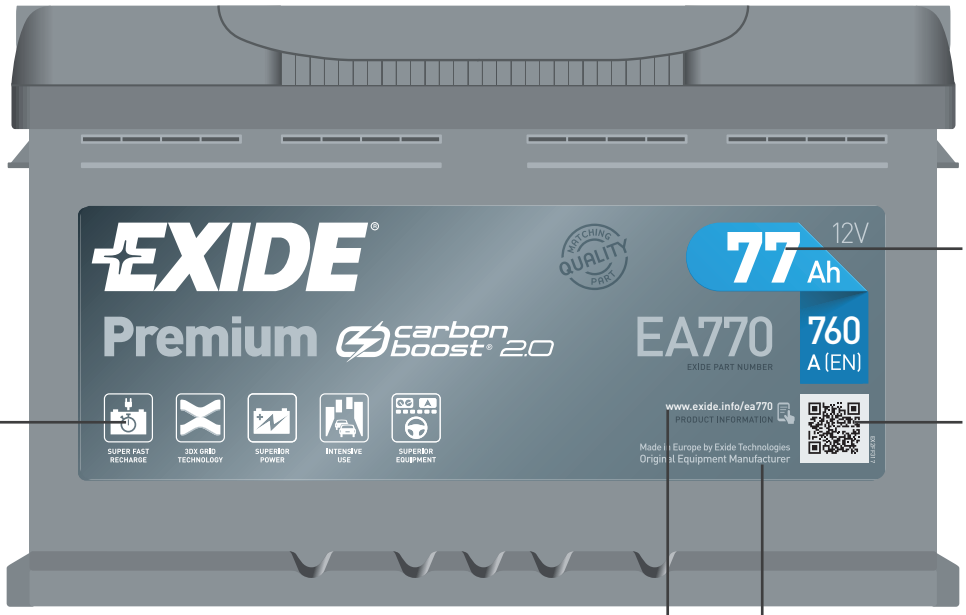
NEW STANDARDS FOR ON-SHELF AND ONLINE COMMUNICATION

- Logical label design
- Emphasis on clear information to make the right battery choice
- Huge improvement for stock handling and retail selection by the end consumer

DIMENSION GRAPHIC
Visually easier to grasp and check

LARGER PART NUMBER
For easier shelf selection

INSTALLATION ADVICE
Reduces risk of incorrect fitment in Start-Stop vehicles



ELECTRICAL PERFORMANCES
Large print for positive verification

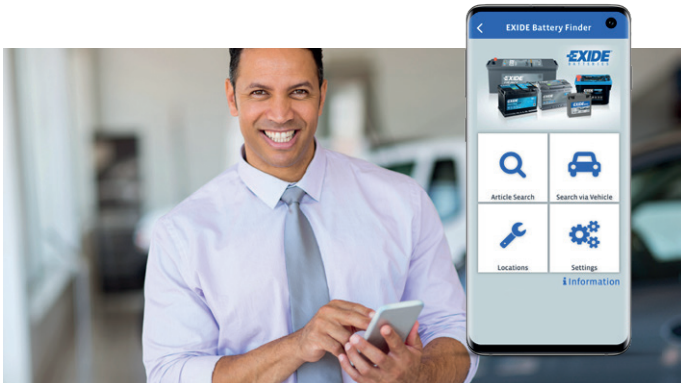
CLEAR BENEFIT ICONS
Greater assurance for end consumer

INDIVIDUAL QR CODE
Smartphone access by simply scanning the code

ORIGINAL-EQUIPMENT MANUFACTURER
Indicator of proven quality

SIMPLE URL
Easier to remember and quick to type for individual product information

APPS AND MOBILE PRODUCT INFORMATION



Exide Battery Finder App

Search by car model, VIN or registration number to find the correct battery fast. A Regularly updated fitment lists for many makes and models of cars, vans, trucks & bikes.

Exide battery catalogue powered by TecDoc in your pocket!

FREE download for iPhone & Android

Mobile Website: www.exide.info

Scan the QR code or type in a simple URL to instantly access product information, user guides, manufacturing information and local contacts.

Available on any internet-connected device

EBTP Exide Battery Tester Programme

Scan the test result from your tester EBT965P and the plate number to identify the correct battery to be replaced, and immediately propose it to the customer, by email or SMS. Test, replace and sell a battery in 5 minutes!

Discover the EBTP here: https://ebtp.exide.com

BATTERY BUSINESS INTELLIGENCE

COUNTER STAFF

KNOWLEDGE OF BATTERY TECHNOLOGY

INFORMATION ON EXIDE RANGE

SALES MATERIALS

USED BATTERY COLLECTION

+

WORKSHOP

WORKSHOP TOOLS

=

END-USER

SATISFACTION

+

LOYALTY

= INCREASED SALES

There are many battery suppliers on the market, but only Exide supports you in all these fields.

Exide is the best partner for your business, offering a broad range of products, unmatched parc coverage and the most advanced technology available.

EXIDE LOCAL REPRESENTATIVES AT YOUR SERVICE

Strong European logistics

Technical knowledge and sales support material

Widest fitment range and full marketing support

Local customer service

Training designed around the needs of your business

OE-quality products and accessories from a trusted brand

Excellent stock and warranty management

THE POWER OF EXIDE'S BRANDS

Exide has a number of national and international brands that have served generations of customers.

These are instantly recognised in local markets, with a reputation for quality and performance. It makes good commercial sense to build upon names that are respected and trusted. Confidence in quality is a very decisive factor in influencing choice.

The power of brands can never be underestimated. From trade counter shelves to the quality of components fitted in customers' cars, people feel more certain of a product that is instantly identifiable.

FAMOUS BATTERY BRAND HERITAGE

Exide
EST. 1900

TUDOR
EST. 1890

Fulmen
EST. 1891

Centra
EST. 1910

Sonnak
EST. 1938

DETA
EST. 1949

KEEPING THE EXIDE BRAND IN FRONT OF MILLIONS OF MOTORSPORT FANS ACROSS EUROPE

EXIDE OE TRUSTED BY LEADING VEHICLE MANUFACTURERS

EQUIPMENT ORIGINAL MANUFACTURER

There has never been such a wide choice of parts available in the aftermarket.

This creates challenges for workshops and trade counters, which must take into account the best product for a particular vehicle, as well as the individual needs of each end-user. In the battery market, Exide has managed to simplify this complexity, offering partners clear ranges of quality batteries and meticulous fitment guides.

All products are designed to match the correct specification and performances expected by vehicle manufacturers. The company has some of the most advanced technologies in the industry. This is combined with a reputation of offering first-class products, and the largest network of European sales offices, with knowledgeable people providing local support. When you see Exide on the label, you can be confident that the battery was manufactured to the highest standards, on the same production lines as the company's OE batteries.

LIGHT VEHICLES		COMMERCIAL VEHICLES						MARINE & LEISURE	
Car		Delivery Truck	Long-Haul Truck	Construction	Agriculture	Passenger Bus & Coach	Bike	Boat	Motorhome
Alfa Romeo	Nissan	Astra		AGCO		Evobus	BMW	Bavaria	Carthago
Audi	Peugeot	Daimler Trucks		Argo Tractors		Iveco		Beneteau	Reisemobile
Bentley	Piaggio	Isuzu		Atlas		MAN		C.N Couach	CS-Reisemobile
Chrysler	Porsche	Iveco		Case New Holland		Scania		Dufour	Fendt Caravan
Citroën	Renault	MAN		Claas		Sennebogen		Jeanneau	Hymer AG
Dacia	Saab	Nissan		Doosan Bobcat Group		Solaris		Lagoon	
DS	Seat	Piaggio		Hinowa				San Lorenzo	
Fiat	Skoda	Renault Trucks		John Deere				Sessa Marine	
Ford	Suzuki	Scania		Komatsu				Wauquiez	
GM	Toyota	Volvo Trucks		Kubota					
Hyundai	Vauxhall			Manitou					
Infiniti	Volkswagen			Mecalac					
Jaguar	Volvo			McCormick					
Jeep				Ravo					
Kia				Same Deutz Fahr					
Lancia				Sennebogen					
Land Rover				Steyr		Exide is also the selected brand of many European city transport operators			
LEVC (London Taxi)				Terberg					
Mazda				Terex					
Maserati				Wacker Neuson Group					
Mini				Wirtgen Group					
				Yanmar					

LEAD-ACID BATTERY STOCK MANAGEMENT AND MAINTENANCE PRACTICES

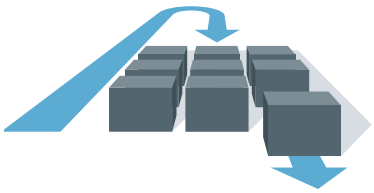
Store batteries in the right way

Storing batteries need a specific approach, different than storing other parts, because environmental conditions affect the life time of each battery.

Although today's technology ensures that batteries have a far longer shelf life than in the past, it is essential to take great care in the handling and storage of these products, so that the battery is at its best when it reaches the customer.

FIFO First-In First-Out

Definition of FIFO: A stock management method in which batteries acquired first, are sold or installed first.



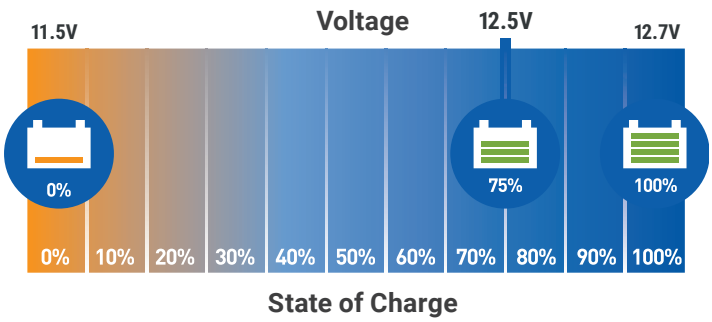
New stock should be placed at the back of the storage rack, so that older stock is used first. The delivery date for each battery should be considered during checking self-discharge and the oldest stock should always be brought to the front of the queue and used before any batteries with a later delivery date.

Check the state of charge of your batteries

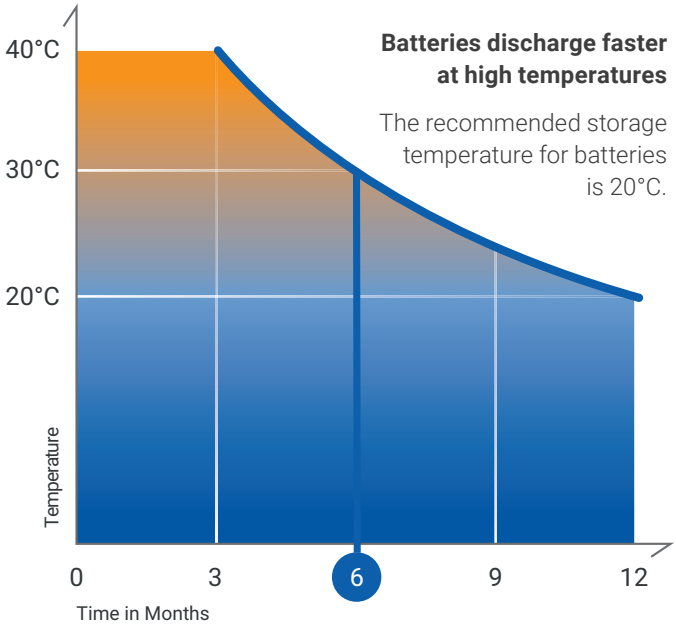
All batteries will slowly self-discharge over time, and it is very important to regularly check the voltage and to ensure that a charge is applied when the battery falls to 75% of its state of charge. Typically, with a lead-acid battery, this occurs at 12.5V. If the voltage should drop below this level, the battery will begin to sulphate.

Sulphation is a process which creates an oxidation layer on the negative plate that will inhibit the current flow and the battery will deteriorate. Recharging is important as soon as this level of self-discharge is discovered, or the capacity loss may be permanent.

Any battery that has dipped below 11.0V will have developed sulphation that will not be remedied by charging. So, it may not deliver the same performance and working life to the customer who purchases this product.



The voltage indicates the state of charge. Recharge every battery at 12.5V or below!



Batteries discharge faster at high temperatures

The recommended storage temperature for batteries is 20°C.

Time (months)

This check is also a good indicator of the age of stock which should ideally be installed within 15 months of the battery's manufacture. This will ensure that products are always in a ready-to-sell state.

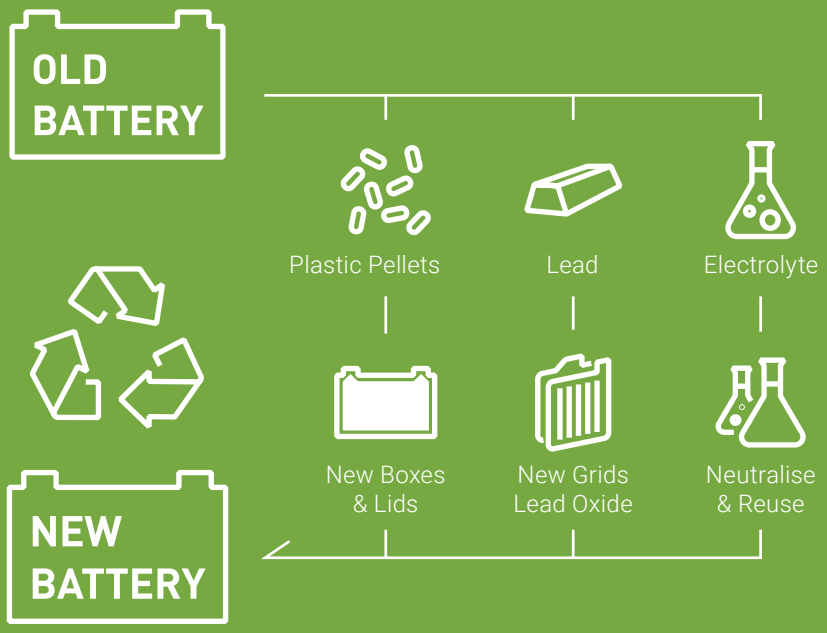
Temperature

The main factor affecting the self-discharge of batteries is the storage temperature. The higher the temperature, the faster self-discharge will occur.

At the other end of the scale, the storage of batteries in a cold environment, where temperatures drop below 0°C should be avoided, as partially discharged batteries risk freezing. This might cause permanent damage and the product will fail or have its working life adversely affected.

If the stock management practices above are followed with care, it should be easy to ensure that all product stock is maintained in a ready-to-sell state and losses through out-of-date or damaged products is kept to a minimum.

THE END IS JUST THE BEGINNING
LEAD-ACID BATTERY RECYCLING



99%
OF AUTOMOTIVE LEAD-ACID BATTERIES
ARE RECYCLED IN EUROPE*

100%
OF A LEAD-ACID BATTERY
CAN BE RECYCLED

3 EXIDE RECYCLING **FACILITIES** IN EUROPE

*Source: Eurobat/IHS Global 2014

Did you know that the Lead-Acid battery is the most successfully recycled consumer product in the modern world? In fact 99% of the battery can be reused.

- The container can be crushed, processed into plastic pellets to make new battery cases and lids.
- The valuable lead in grids and terminals is smelted and re-formed to make new grids and lead oxide.
- Even the electrolyte is neutralised and chemically processed to extract the sulphuric acid.

There are universal regulations to stop scrap batteries being disposed of in landfill, resulting in the release of harmful chemicals that affect our environment. But with increasing value of the raw materials, there is an economic benefit beyond contributing to our social obligation.

LITHIUM-ION BATTERIES
IMPORTANT SAFETY NOTICE

issued by Eurobat

- **Do NOT send lithium-ion batteries to lead recyclers**
  Use an approved facility for treatment and recycling.
- **There is a serious RISK OF FIRE and EXPLOSIONS if lithium-ion batteries enter the lead battery collection and recycling process**
- **Batteries can appear similar, so make sure lead and lithium-ion batteries are IDENTIFIED and SORTED**

Tips to identify battery types

Read the label - Look out for the Pb symbol on lead batteries or the Li symbol on lithium-ion batteries.

You may also be able to identify them by their manufacturer.

Notice the weight difference - Although they have similar dimensions lithium-ion are much lighter than lead batteries.

TERMINOLOGY GUIDE

Absorbed glass mat (AGM)

Type of lead-acid battery in which the electrolyte is absorbed into a fibreglass mat. The plates in an AGM Battery are generally flat, but in cylindrical AGM's, the plates are thin and wound in a tight spiral, sometimes referred to as spiral wound.

Ampere, or Amp

The unit of measurement of current flow. One volt placed across a one ohm resistance will cause a current of one Amp to flow. One amp for one hour is called an "amp-hour" or Ah.

Ampere-hour or Ah

The unit of electrical capacity - this tells you how much energy the battery will store. Current multiplied by time in hours equals ampere-hours. A current of one amp for one hour would be one amp-hour; a current of 3 amps for 5 hours would be 15 Ah.

Battery

A battery is an electric device that converts chemical energy into electrical energy, consisting of a group of electric cells that are connected to act as a source of direct current. Batteries are made of connected cells encased in a container and fitted with terminals to provide a source of direct electric current at a given voltage. A battery is characterised by its chemical composition (combination of metal(s) and electrolyte used), voltage, size, terminal arrangements, capacity and rate of capability or more cells.

Battery pack (bank)

Set of any number of (preferably) identical batteries or individual battery cells. They may be configured in a series, parallel or a mixture of both to deliver the desired voltage, capacity, or power density.

Cell

Basic functional unit providing a source of electrical energy by direct conversion of chemical energy. A cell consists of two dissimilar substances, a positive electrode and a negative electrode, that conduct electricity, and a third substance, an electrolyte, that acts chemically on the electrodes. The two electrodes are connected by an external circuit. The electrolyte functions as an ionic conductor for the transfer of the electrons between the electrodes.

Cycle

A "cycle" is a somewhat arbitrary term used to describe the process of discharging a fully charged battery down to a particular state of discharge. The term "deep cycle" refers to batteries in which the cycle is from full charge to 80% discharge. A cycle for an automotive battery is about 5%, and for telephone batteries is usually 10%.

Electrolyte

Conductive chemical (such as acid), usually liquid, solid or gel, in which the flow of electricity takes place within the battery, and which supports the chemical reactions required.

Lead-acid battery

Lead-acid batteries are still the most common type of rechargeable automotive batteries, after over 150 years in use. Their power-to-weight ratio is often quite good. Also, the energy-to-volume ratio is good compared to other types of batteries. They are more economical and supply high burst of energy needed to start engines.

Separator

Material with an ion permeable structure that provides electrical insulation between plates of opposite polarity in a cell.

SLI

Starting, Lighting and Ignition.

Storage battery

A storage battery consists of several cells connected to each other. Each cell contains a number of alternately positive and negative plates, a separator and electrolyte. The positive plates of the cell are connected to form the positive electrode; similarly, the negative plates form the negative electrode.

During the process of charging, the cell is made to function in reverse of its discharging operation; i.e., current is forced through the cell in the opposite direction, causing the reverse of the chemical reaction that ordinarily takes place during discharge, so that electrical energy is converted into stored chemical energy.

Valve-regulated sealed battery

Battery in which cells are closed but have an arrangement (valve) which allows the escape of gas if the internal pressure exceeds a predetermined value.

Vented cell

Cell with a cover having an opening through which products of electrolysis and evaporation are allowed to escape freely from the cell, in order to avoid excessive pressure inside the cell.

Vent valve

Part of certain types of batteries which permits the escape of gas in the case of excess internal pressure but which does not allow the entry of air.

Volt (V)

The unit of measurement of electrical potential or "pressure". Most batteries come in 6, 12, & 24 volt. A single cell is 2 volts.

Watt (W)

A unit of power. 1W is 1 Joule per second (J/s), or also 1 amp multiplied by 1 volt (AxV). 1 amp at 120 volts gives the same result in watts as 10 amps at 12 volts.

Watt-hour (Wh)

Watt-hours measure amounts of energy for a specific period of time. For example if a 60W light bulb is on for one hour, then that light bulb will have used 60Wh of energy. If left on for two hours, then the 60W light bulb will have used 120 Wh of energy.

AFTERMARKET FACTS AND FIGURES

EUROPEAN VEHICLE PARC AND SEASONAL BATTERY SALES

Light Vehicle Parc < 3.5 t

		,000 units
1	Germany	49,821
2	Italy	43,743
3	France	38,267
4	United Kingdom	35,926
5	Spain	28,714
6	Poland	26,078
7	Netherlands	9,527
8	Romania	7,211
9	Belgium	6,623
10	Portugal	6,403
11	Czech Republic	6,323
12	Greece	6,054
13	Sweden	5,442
14	Austria	5,402
15	Switzerland	4,987
	Others	28,761
	Total	**309,280**

TOTAL EU27 + Iceland, Norway, Switzerland & UK **309m**

Other significant markets

	Russia	47,634
	Turkey	16,641
	Ukraine*	11,121

Source:
European Automobile Manufacturers' Association (ACEA) 2018 (*2016 data)

Commercial Vehicle Parc > 3.5 t

		,000 units
1	France	6,890
2	Spain	5,272
3	Italy	5,151
4	United Kingdom	5,097
5	Poland	3,878
6	Germany	3,752
7	Portugal	1,267
8	Netherlands	1,174
9	Greece	1,147
10	Romania	1,091
11	Belgium	932
12	Czech Republic	784
13	Sweden	670
14	Norway	611
15	Hungary	561
	Others	3,353
	Total	**41,630**

TOTAL EU27 + Iceland, Norway, Switzerland & UK **42m**

Other significant markets

	Russia	4,165
	Turkey	1,128
	Ukraine*	1,714

Source:
European Automobile Manufacturers' Association (ACEA) 2018 (*2016 data)

Motorcycle/Moped Parc

		,000 units
1	Italy	8,721
2	Germany	6,221
3	Spain	5,393
4	France*	3,034
5	Poland	2,853
6	Netherlands	1,697
7	Greece	1,583
8	United Kingdom	1,265
9	Czech Republic	1,132
10	Switzerland	941
11	Austria	847
12	Belgium	664
13	Finland	648
14	Portugal	616
15	Sweden	386
	Others	1,801
	Total	**37,784**

TOTAL EU27 + Iceland, Norway, Switzerland & UK **38m**

Other significant markets

	Russia	2,375
	Turkey	3,276

Sources:
European Association of Motorcycle Manufacturers (ACEM) 2018 (*2017 data), Autostat (Russia) 2018, Motorcycle Industry Association of Turkey (MOTED) 2019

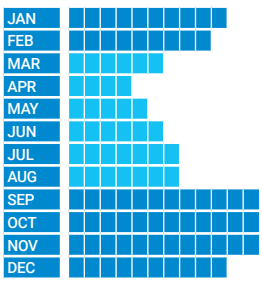
Motorhome/Caravan Parc

		,000 units
1	Germany	1,207
2	France	1,041
3	United Kingdom	780
4	Netherlands	553
5	Sweden	385
6	Spain	360
7	Italy	284
8	Norway	169
9	Denmark	138
10	Finland	124
11	Switzerland	95
12	Belgium	90
13	Austria	66
14	Portugal	28
15	Slovenia	16
	Others	65
	Total	**5,400**

TOTAL EU27 + Iceland, Norway, Switzerland & UK **5.4m**

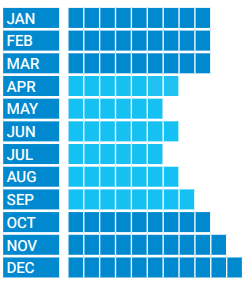
Source:
European Caravan Federation (ECF) 2018

Light Vehicle Seasonal Battery Sales



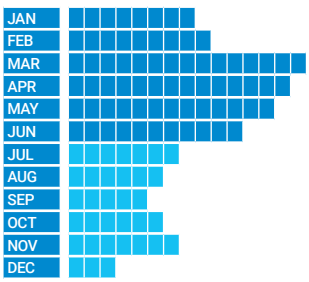
Peak sales period:
September to February

Commercial Vehicle Seasonal Battery Sales



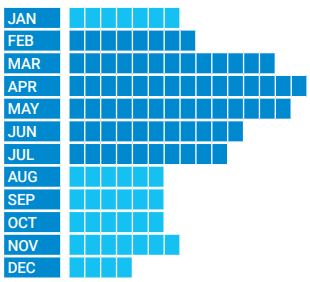
Peak sales period:
October to March

Motorcycle and Powersport Seasonal Battery Sales



Peak sales period:
January to June

Motorhome/Caravan Seasonal Battery Sales



Peak sales period:
February to July

BATTERY REPLACEMENT CYCLE

Boat Parc

		,000 units
1	Sweden	781
2	Norway	758
3	Finland	710
4	Italy	510
5	United Kingdom	500
6	France	485
7	Netherlands	408
8	Germany	404
9	Denmark	310
10	Spain	174
11	Greece	135
12	Croatia	104
13	Switzerland	85
14	Austria	65
15	Poland	35
	Others	196
	Total	**5,660**

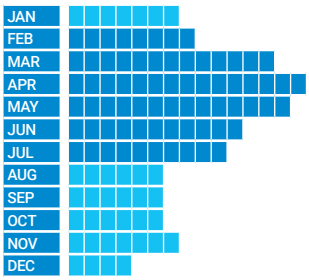
TOTAL EU27 + Iceland, Norway, Switzerland & UK **5.7m**

Other significant markets

	Turkey	72
	Russia	30
	Ukraine	15

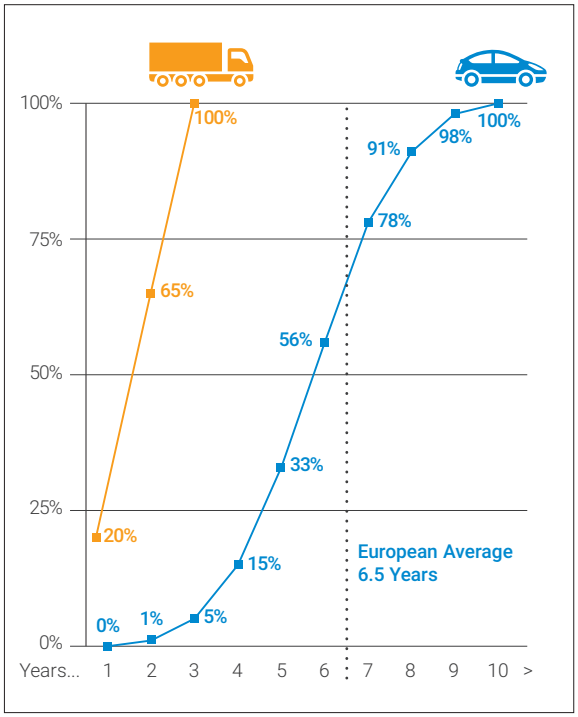
Source:
International Boat Industry (IBI) 2015

Boat Seasonal Battery Sales



Peak sales period:
February to July

LV & CV Battery Replacement Cycle



Key points of battery replacement cycle:

Light vehicles' replacement cycle

(average 1 battery per vehicle)

- Minimal battery replacement in the first three years
- More than 50% of batteries replaced by the sixth year
- 100% of batteries replaced within ten years

Heavy vehicles' replacement cycle

(average 1.7 batteries per vehicle)

- 20% of batteries replaced within the first year
- 65% of batteries replaced within the second year
- 100% of batteries replaced within three years

Heavy vehicle batteries have a shorter life due to longer annual distances covered and the higher energy requirements caused by their greater weight and usage.

Factors that influence all battery replacement rates include vehicle parc age, on-board electrical equipment and service frequency. Regional climate also effects overall battery life.

Source: Eurobat Study
(The availability of automotive lead-based batteries for recycling in the EU)

Average Age of European Vehicles

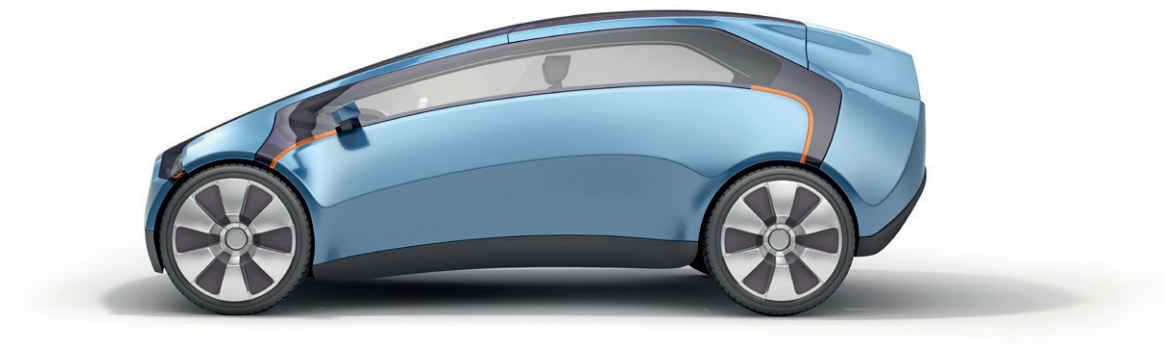
	Cars	Vans	Trucks
EU AVERAGE	**11.1**	**11.0**	**12.0**
Austria	◄ 9.0	◄ 8.0	◄ 8.4
Belgium	◄ 7.9	◄ 8.2	◄ 9.6
Croatia	14.7 ►	12.1 ►	14.4 ►
Czech Republic	14.7 ►	12.9 ►	13.9 ►
Denmark	◄ 8.3	◄ 8.4	◄ 7.6
Estonia	15.4 ►	12.7 ►	16.3 ►
Finland	11.2 ►	11.6 ►	12.0
France	◄ 9.3	◄ 8.6	◄ 7.1
Germany	◄ 9.4	◄ 7.6	◄ 8.4
Greece	14.6 ►	17.3 ►	18.9 ►
Hungary	15.3 ►	13.8 ►	12.6 ►
Ireland	◄ 8.5	◄ 8.9	◄ 10.3
Italy	11.3 ►	12.4 ►	14.0 ►
Latvia	16.1 ►	12.7 ►	16.3 ►
Lithuania	16.9 ►	11.9 ►	◄ 11.6
Luxembourg	◄ 6.4	◄ 6.3	◄ 6.5
Netherlands	◄ 10.0	◄ 8.9	◄ 8.0
Poland	17.3 ►	16.4 ►	16.4 ►
Portugal	12.9 ►	14.3 ►	13.7 ►
Romania	16.1 ►	15.3 ►	15.3 ►
Slovakia	13.7 ►	12.6 ►	12.5 ►
Slovenia	11.5 ►	◄ 9.0	◄ 9.8
Spain	12.1 ►	12.6 ►	12.9 ►
Sweden	◄ 9.8	◄ 8.0	◄ 8.7
United Kingdom	◄ 8.8	◄ 8.8	◄ 9.2

EU27 + UK.
Data not available for Bulgaria, Cyprus & Malta.

◄ = Below average ► = Above average

Source:
European Automobile Manufacturers' Association (ACEA) 2017

A SECOND CENTURY OF INNOVATION – DRIVING A BETTER FUTURE



The Exide story started over 130 years ago, and the company has been at the forefront of innovation throughout its rich and fascinating history. As the automotive industry evolved from novelty to main-stream, it served drivers with easier, safer, bigger and faster vehicles. At every stage, greater demand was put on the battery, and Exide responded with constant product improvements or by developing entirely new variants of lead-acid batteries.

Today's priorities are centred on higher levels of vehicle automation, connectivity and greater fuel efficiency. With its state-of-the-art research centre in Germany, Exide continues to lead the battery R&D.

Exide is also taking part in research partnerships with car manufacturers and scientific research consortiums. The key focus points revolve around electronics, new alloys and additives, improved separators, and cutting-edge production processes. These are all essential aspects in the company's own testing and performance evaluations of smarter battery management systems and advanced battery technology.

Exide is developing the batteries that will power the next generation of cars.

EXIDE TIMELINE
MAKING THE VITAL COMPONENT TO PROGRESS

1880s

The Electric Storage Battery Company is set-up in 1888

Accumulator cells are made to power new battery trams

1890s

Construction of the first large central station battery of 130 cells of 800 ampere-hours capacity

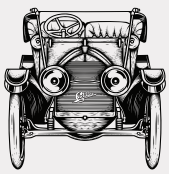
Cells are supplied for the world's first common-battery telephone exchange

1900s

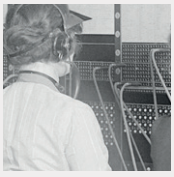
New battery branded 'Exide', are developed to power electric vehicles

The world's first feasible submarine is powered by Exide Batteries

1910s



1912 Cadillac – world's first production car with electric ignition is made possible by new Exide starter battery



Exide Chloride is used in equipment to power first long distance telephone call and first transatlantic speech transmission

1920s

Exide plays a crucial role on Amundsen 3 year Arctic Expedition, as well as many other explorations around the globe

The first talking pictures are made possible with Western Electric sound technology, including Exide batteries

1930s

Piccard's Stratospheric Balloon Flight. Exide ensures radio contact is maintained throughout the epic 8 hour flight

Exide battery solutions are developed for railway signalling and passenger car lighting

1940s

Exide increases wartime production for aircraft starting, radio, radar, electric torpedos and close proximity fuses

Launch of Exide-Ironclad which quickly becomes the most popular power in battery traction

GNB INDUSTRIAL POWER

A DIVISON OF EXIDE TECHNOLOGIES

GNB is highly respected for its knowledge, experience and a wide range of products in Motive and Network Power.

Combined with Exide's expertise in Transportation, the two entities share their resources and passion for innovation to bring even better energy storage solutions to the market.

MOTIVE POWER

FORK LIFT

GROUND SUPPORT EQUIPMENT

LIFTING PLATFORM

PERSONAL MOBILITY & GOLF CARTS

BATTERY LOCOMOTIVES

NETWORK POWER

TELECOMS

UNINTERRUPTED POWER SUPPLY (UPS)

RENEWABLE ENERGY & ELECTRIC UTILITY

RAILWAYS

DATA CENTRES

1950s

Sonnenschein

Sonnenschein patents Dryfit GEL technology

Exide develops the Henney Kilowatt 72V electric car

1960s

First Exide batteries on the moon. In 1966 on unmanned Surveyor missions followed by Apollo 11, first manned lunar landing in 1969

1970s

Exide Sundancer electric car project is powered by 13 Exide Willard Electric Vehicle Batteries

1980s

Exide celebrates the first 100 years of innovation

1990s

Exide official NASCAR Select Batteries

New advanced Exide Orbital technology is developed for automotive and marine power applications

2000s

Exide launches the first Start-Stop AGM & EFB batteries in the European aftermarket

Sonnenschein batteries for cell network system are installed at 6,500m on the highest base camp of Mount Everest

2010s

Exide introduces Lithium-ion batteries in Motive Power, Powersports and Marine & Leisure into its offer

Dual battery systems are designed by Exide for Scania and other major truck manufacturers

THE CITY BATTERY

THE MOST RELIABLE STARTING FOR INTENSIVE URBAN USE BY TAXIS, COURIERS, EMERGENCY VEHICLES, UTILITY COMPANIES...

EXIDE® EFB

carbon boost® 2.0

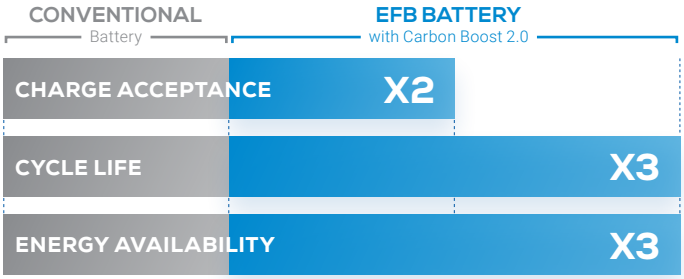
3DX GRID TECHNOLOGY | REGENERATIVE BRAKING | INTENSIVE USE | RECOMMENDED FOR START-STOP

EXTRA LIFE FOR CONVENTIONAL & START-STOP VEHICLES

First invented by Exide in 2008, EFB batteries have come to play an increasingly crucial role for car manufacturers in order to reduce fuel consumption and emissions. Now Exide brings the latest OE generation to the aftermarket, featuring Carbon Boost 2.0.

The latest Exide EFB battery supports all vehicles, with and without Start-Stop systems, which have high cycling requirements.
When installed in cars with a Start-Stop system, Exide's EFB battery shows unmatched energy recovery and exceptional dynamic charge acceptance. Unlike most other EFB batteries, Exide EFB is recommended for vehicles incorporating regenerative braking. Compared to standard flooded batteries it also benefits from a longer overall lifespan, when installed in cars with conventional power train.

Exide EFB offers significant performance advantages over a conventional battery when fitted into a car without Start-Stop system



EXIDE TECHNOLOGIES

POWERING THE WORLD **FORWARD**

EMEA Headquarters
Exide Technologies SAS
5 allée des Pierres Mayettes, 92636 Gennevilliers France
Tel: +33 1 41 21 23 00 www.exide.com/eu/en