



## Practical Guide





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*This practical guide could be changed without notice.*



## 1. APPLICATION AND TYPES OF BATTERIES

Batteries are mainly classified depending on their field of usage: the two main categories are starting applications and energy applications (*deep-cycle*). In the first case, a battery or **starter accumulator** has the **main function to provide high current intensity (inrush current or cranking current) for a very limited time** (usually less than 5 seconds). The battery, which is the hearth of the starting system, must provide the necessary power to spark a diesel/gasoline engine. Small displacements engines often include both pedal and electric starter, while large displacements engine use only the electric starter. As will be seen, **Aliant X and X-P series are lithium phosphate starter batteries with very low maintenance and important electrical and mechanical features**, and also a low environmental impact.



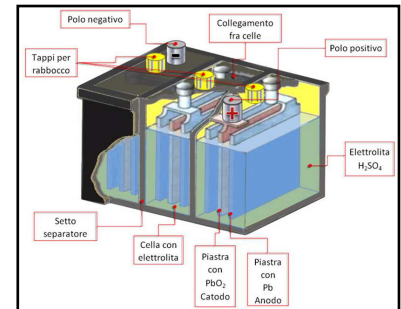
**Cyclic or stationary batteries** are commonly used in energy applications, where the main requirement are deep discharge cycles (up to 80% of the rated capacity), hence the term *deep-cycle*. They are mainly used in traction sector (electric vehicles used on golf courses, or forklift). In some cases, such as a photovoltaic streetlight, the battery must remain charged, without being damaged or present a premature aging even if already charged to 100% (for lead acid batteries that is possible through a charge controller that prevents overcharging, deleterious events that can lead to bursting). Other applications are service businesses, such as: telecommunications, campers, boats and electricity in homes isolated from the electric grid, or wherever it is necessary to provide a continuous supply of energy to ensure a request. All those

batteries are used in consumer products such as cameras, cell phones, MP3, computers that require a high autonomy and are considered cyclical. Actually, while in the world of starter batteries the main choice is mainly **lead-acid batteries**, in the second case, compared to an increasingly high demand for integration and high energy density, the market share is 90% of **lithium batteries**, because they can store more energy in less space and weight! For example, lithium batteries used for electric bike traction (eBike). Very low self-discharge currents, high density of energy and lower weight are just some of the best features of lithium-ion technology. A deeper description of the technologies mentioned in this first part will be better discuss in the following pages. Just for information, we believe is useful to consider the market presence of other technologies types as NiCd and NiMH batteries which we are not going to describe the characteristics, nevertheless in the graphical analysis in section 1.5.



## 1.1 LEAD ACID BATTERIES

The **lead-acid battery** consists of a series of galvanic cells in which takes place a reversible redox reaction through which it is possible, alternatively **"store"** and **"pick-up"** electricity. The lead-acid battery cell is made by a vessel with inside an electrolyte (aqueous solution of sulfuric acid) where are immersed two electrodes placed in parallel, one of which is made by a lead dioxide sheet (positive electrode) while the other one is made by a lead metallic sheet (negative electrode).



- **Discharge** : the electrodes reacts with the sulfuric acid present in the electrolyte solution to form water and lead sulfate which cause the decrease of sulfuric acid concentration in the electrolyte solution and therefore of its density. The redox reaction occurs on the contact surface between the electrodes and the electrolyte, therefore **the electric current intensity generate is directly proportional to the contact surface area between electrodes and electrolyte**. Bigger is the contact surface and bigger will be the number of molecules who become part of the reaction producing a more intense electrons flow.
- **Charge** : thanks by an opposite current direction, where the electrons flow moves from the positive to the negative, there is a gradually restore of the beginning concentration of sulfuric acid in the electrolyte solution, with the disappearance of the lead sulphate created during the discharge. If the complete charged is achieved (fully charged), and **the charger continues to provide energy to the battery** there is no further increase in charge, but: 1) the **additional energy provided produces electrolysis** of water molecules present in the solution **with the formation of hydrogen and oxygen in molecular state (gas), a condition extremely dangerous as the mixture of the two gases can be explosive**, 2) water loss from the solution with a consequent variation of the energy density.
- **Sulphation** : in the discharge and charge process of a lead accumulator chemical reactions that are involved, cause during the discharge cycle to the production of lead sulphate and its subsequent reabsorption in the charging state, with the restoration of the initial density of the electrolyte solution of sulfuric acid. Chemically, **the lead sulphate is a salt and therefore tend to crystallize or to compact into a solid structure deposited on the electrodes in an irreversible way, decreasing the ability to accumulate / return charges, this process is called sulphation**. The electrodes sulphation leads to a complete battery sulphation and that's why the battery is irreversibly damaged. The main cause of this irreversible phenomenon is the permanence of the accumulator in discharged condition. **The temperature increasing cause a nominal capacity increasing of the battery and at the same time cause adverse effects such as bigger self-discharge current and therefore the sulphation effect**, for that reason the temperature has a negative impact on the battery.

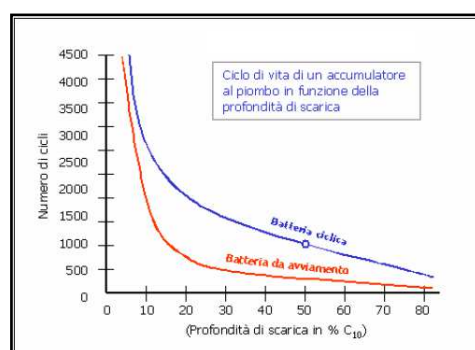


**Construction types.** The manufacturing way of lead-acid batteries are different. Old batteries with an aqueous solution of sulfuric acid were used up to twenty years ago in cars, where a strong maintenance activity was necessary to ensure proper operation, such as the manual topping-up of the electrolyte. Today, the market share is wider for **VRLA** batteries: they **replaced the aqueous electrolyte with a gelatinous substance** that provides the

advantage of avoiding dehydration and accidental spillage of corrosive liquid content (sulfuric acid). The structural features of VRLA suggested to be described as "sealed" (SLA or *Sealed Lead Acid*) batteries, but in reality these are not really sealed, because in their operation must be given the opportunity to freed up the gases generated during charge / discharge cycle in the air. The vent valves, which provide this specific adjustment of the internal pressure, determine the allocation of VRLA (Valve Regulated Lead Acid). Therefore, with VRLA or SLA can be identified the modern battery type, where are not require electrolyte refilling activity or other kind of maintenance. However, the term **"Maintenance Free" batteries often used in the SLA is improper**, as they need to provide a frequently recharge during rest period to avoid sulphation phenomenon and as consequence a quick degradation of the battery life. It can be asserted that the maintenance level necessary for a VRLA battery is certainly less than the solution with liquid electrolyte. The main VRLA batteries are:

- A) **AGM batteries** (*Adsorbed Glass Material*) consists of an absorbent fiber glass electrolyte, a solid material that guarantees no leakage acid even if broken. This fiber glass absorbs the battery acid as a sponge, allowing a more efficiently use, limiting space and volume of the battery, therefore a best starting performance. Since the plates of a battery AGM are very compact, the resistance to vibrations is better than the standard batteries. Another important feature of these batteries is that oxygen and hydrogen, formed during charging, recombine generating water directly inside the battery, ensuring extremely contained water loss.
- B) **GEL batteries**, their manufacture feature is the gel state electrolyte and not in liquid form, which makes the electrolyte like a solid and gelatinous mass, thereby it is impossible acid leakage even if the case broke or overturned. These batteries requires to be loaded with currents and voltages lower than other batteries, otherwise there is the possibility to generate, inside the gel electrolyte, bubbles gas such as to damage them permanently. It's important not to load them with fast and cheap charger, which would cause a rapid life degradation.

In case of lead batteries, **the main difference between a cyclic and a starter battery is the electrodes structural shape**. A greater amount of cell lead match to a greater store energy capacity of the cell. Although larger and thicker electrodes producing the same voltage (2.16 V) of small and thin electrodes, are able to delivering much more energy for a longer time since they can store a larger number of charges (electrons). **Starter batteries, made with thin and porous electrodes, as for same capacity are able to provide high peak current for short periods but is not possible to continue the discharge over 40% - 50% of its rated capacity without causing an irreversible structural and mechanical electrodes alterations**. The cyclic batteries, however, realized with thick and compact electrodes are not capable of delivering / accept strong currents as allow to carry out many charge/discharge cycles (about 1000) that can safely reach the 80% total capacity depth.



## LITHIUM

### 1.2 LITHIUM ION BATTERIES (Li-Ion)

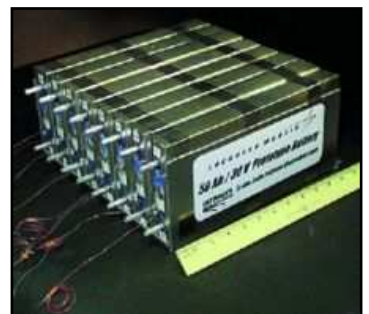
Lithium-ion batteries are a type of battery commonly used in electronics consumer (laptops, mobiles ..) thanks to an excellent energy-weight rate (they are much lighter than the equivalents manufactured with other chemicals materials, through a very high lithium ions charge density). The memory effect absence, a low charging loss (approximately a 5% monthly against 20% - 30% of other solutions), quick time charging (maximum 1,5 hours for a full charge) are some of the main advantages. The single cell Li-Ion batteries should never be discharged below a set voltage to avoid irreversible damage, that's why Li-Ion batteries systems are equipped with a shut-down circuit who turn off the system when the battery is discharged below the predefined threshold. Therefore is impossible drain the battery "deeply" into a system designed to operate properly during normal use. The chemistry of Li-Ion batteries can explode if overheated or over-loaded, so they require different mandatory safety systems to be considered safe for general use. In conclusion, the main advantages over other chemical solutions are:



- **High energy density**, many people prefer this technology in consumer electronics;
- **Lower weight** up to 40%;
- **No memory effect**, the battery can be charged at any time without capacity reducing;
- High autonomy due to **low self-discharge**;
- **Fast charging time**;
- Better **environmental compatibility** thanks to the absence of heavy metals.

### 1.3 LITHIUM POLYMER BATTERIES (LiPo)

The last "release" of the lithium ion battery is the lithium polymer battery. The main manufacturing feature against lithium ion batteries is the salt lithium electrolyte made by a composite of solid polymer and is not contained in an organic solvent like lithium ion batteries. The solid polymer is a non-flammable material (unlike the organic solvent used by Li-Ion cells) and therefore with a lower risk if damaged. In Lithium-ion cells the rigid container press each the electrodes towards the separator, while in the polymer that external pressure is not required because the "sheets" of the electrode and the "sheets" of the separator (dielectric) are laminated one to each other. The manufacturing technology allows a better energy density of LiPo, more than 20% compared to a traditional lithium-ion and it is about three times better than NiCd and NiMH batteries. The Li-Po batteries can deliver maximum power for short durations, typically require more than an hour to a full charge and have a lower life expectancy. This technology using lithium electrolyte must be used with a specific charger. If of short-circuited battery, can explode and catch fire easily if drilled and / or the cabinet damaged caused by a very low internal resistance and a consequent pulse current flowing through it.



## 1.4 LITHIUM IRON PHOSPHATE BATTERIES (LiFePO4)

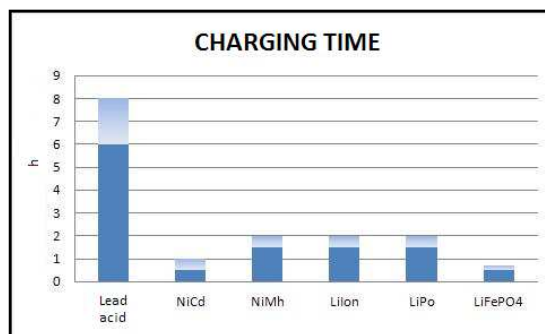
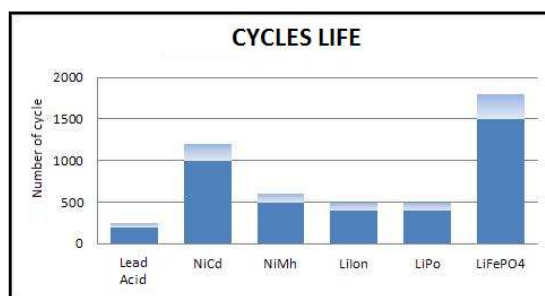
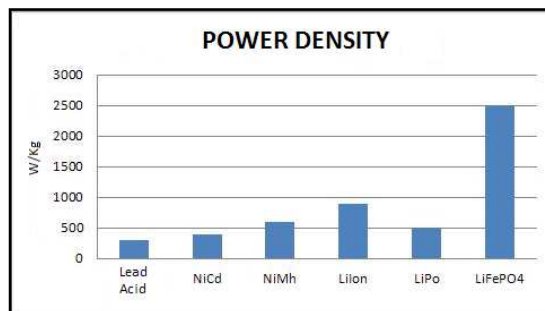
It is considered the future battery. Unless an imminent revolutions, the old lead-acid battery will be slow to die but the LiFePO<sub>4</sub>, mediating between the various lithium types, in the future it will be able to compete in all applications, both in the terms of increased power density as for stability and reliability. The **main qualities of LiFePO<sub>4</sub> are: chemical stability**, which does not generate oxygen or other harmful or incendiary substances, **good energy density**, **high power density able to generate average currents also of various C**, **good charging time and in some cases, rapid like Aliant with selected components characterized by high performance**. Do not forget the large number of cycles, 1500 average. The only drawback of the LiFePO<sub>4</sub> is the high cost of the cells, which is expected to fall during the next 5 years.



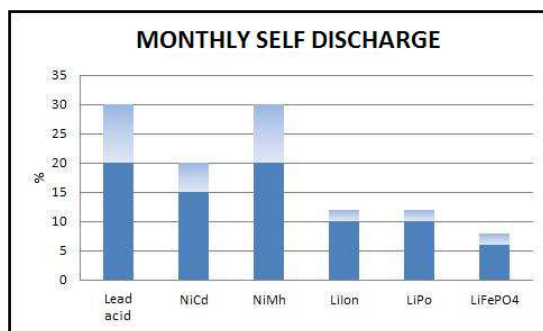
## 1.5 ALIANT (LiFePO4) COMPETITIVE ANALYSIS VS OTHER BATTERIES

In this last section is very important to show graphically the main features of the different manufacturing technologies:

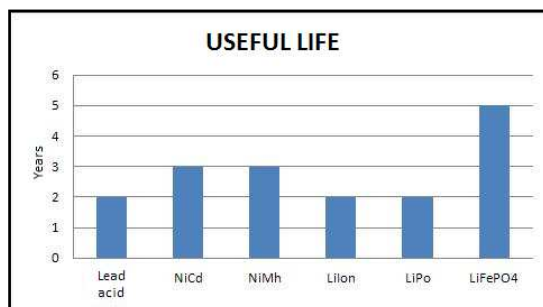
- POWER DENSITY (W/Kg):** basic feature for a starting battery. This value is the maximum power that the battery can deliver on a kg weight. Aliant can achieve **high peak currents over of 240 A for 10 seconds as for 880 grams battery**, a discriminating factor for all those applications which requires high starting currents and extremely reduced weights.
- CYCLES LIFE (N.):** in this case is considered the potential of the product as a function of the maximum number of cycles (charge and discharge) for his entire life. As mentioned previously, due to very strong chemical bond between the lithium-iron-phosphate, we can see the values shown in the table, which indicate how the lithium phosphate batteries having a longer life compared to other chemical products.
- CHARGING TIME (h):** This feature affects all those people who were left with a flat battery at the wrong time, or felt the need to recharge the battery in a very short time. With Aliant, you can start in less than 10 minutes with a 50% recharge and 30 minutes for full charge at 100%.



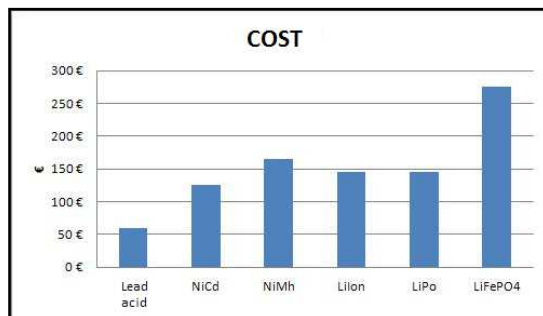
- 4) **MONTHLY SELF DISCHARGE:** Another main parameter for the maintenance of charge of its own battery. All batteries have a value of self-discharge, which is minimal for the  $\text{LiFePO}_4$



- 5) **USEFUL LIFE:** A continuous use of the battery for long time, at least once a week ensures excellent results for the lithium technology. The battery life is seriously affected by the correct use and recharge process during the lifetime. Wrong battery charger and a bad batteries use, especially for Lead Acid, which require a high level of maintenance, lasting less than promised.



- 6) **COST (€/Wh):** The cost is not an plus for lithium phosphate technology, but, if considered this technology can last more than twice of any other battery on the market, with less maintenance, less weight and all other advantages as described before. The graph on the right shown how cost a 12V - 17Ah lead battery / VRLA compared to a 12V - 9Ah for a lithium phosphate battery.



It is considered useful to shown in the following tables the different performance concerning the different batteries on the market. In the first table are shown the features between the manufacturing technology from the chemical point of view, while in the last table is illustrate the same features between the various lithium type batteries.

**TABLE 32.3** General Secondary Battery Comparison for Consumer Applications

Characteristic	NiCd	NiMH	Lithium-Ion
Cell voltage	1.2	1.2	3.6–3.7
Cycle life at 80% DOD	1000+	500+	400–500
Temperature range	–40 to 70°C	–40 to 50°C	–20 to 60°C
Memory effect	Yes	Yes	No
High rate discharge	10C +	Up to 5C	Up to 2C (typical)
Fast charge time	< 1 h	2 h	2 h
Capacity after 1 year storage @ 25°C	< 30%	< 20%	80%
Energy density @ 10 h discharge rate	60 Wh/kg	90 Wh/kg	230 Wh/kg

Lithium batteries are named depending on the used material for the cathode (positive electrode), while the anode (negative electrode) is generally made in carbon. During the cycling there is a continuous lithium ions exchange between the electrodes. The cathode is typically a metal oxide with a layered structure, such as  $\text{LiCoO}_2$  (lithium

cobalt oxide), or a material with a tubular structure such as  $\text{LiMn}_2\text{O}_4$  (lithium manganese oxide). In recent years there have been developments in positive electrodes such as  $\text{Li}/(\text{Ni-Co-Mn})\text{O}_2$  or  $\text{LiFePO}_4$  with obvious advantages over previous versions:

**TABLE 32.4** General Rechargeable Lithium-Ion Battery Comparisons

Characteristic	$\text{Li}/\text{CoO}_2$	$\text{Li}/\text{Mn}_2\text{O}_4$	$\text{Li}/(\text{Ni-Co-Mn})\text{O}_2$	$\text{Li}/\text{FePO}_4$
Cell voltage	3.6 +	3.6	3.5–3.8	3.2
Cycle life	400–500	400–500	400–500	1000+
Temperature range	–20 to 60°C	–20 to 60°C	–20 to 50°C	–20 to 60°C
Discharge rate	Up to 2C	Up to 5C	Up to 1.5C	10C+
Charge rate	2 h	1–2 h	2–3 h	<1 h
Energy density @ C/5 discharge	200 Wh/kg	150 Wh/kg	230 Wh/kg	120 Wh/kg

Through the above tables (Linden's Handbook of Batteries edited by Thomas B. Reddy) and other known data, we obtain the following final table, in which are pointed out the important characteristics for a battery.

FEATURES	Piombo Acido	NiCd	NiMh	Lilon	LiPo	LiFePO4
POWER DENSITY (W/Kg)	300	400	600	900	500	2500
ENERGY DENSITY (Wh/Kg)	50	60	90	230	150	120
CYCLE LIFE (@80% D.O.D.)	200	1000	500	400	400	≥1500
USEFUL LIFE (YEARS)	2	3	3	2	2	5
CHARGING TIME (H)	7	1	2	2	2	0,5
CHARGE EFFICIENCY (%)	60	75	70	90	90	95
MONTHLY SELF-DISCHARGE (%)	30	20	30	12	12	≤8
SAFETY	GOOD	GOOD	GOOD	BAD	QUITE GOOD	EXCELLENT
MEMORY EFFECT	NO	YES	LIMITED	NO	NO	NO

**The Aliant  $\text{LiFePO}_4$  battery are already convenient and/or competitive with all the best acid batteries on the market.**

## 2 ALIANT LiFePO<sub>4</sub> – STARTER BATTERIES

The lithium technology chosen for Aliant battery is LiFePO<sub>4</sub>. The following features has been predominant for the development of our project / product:

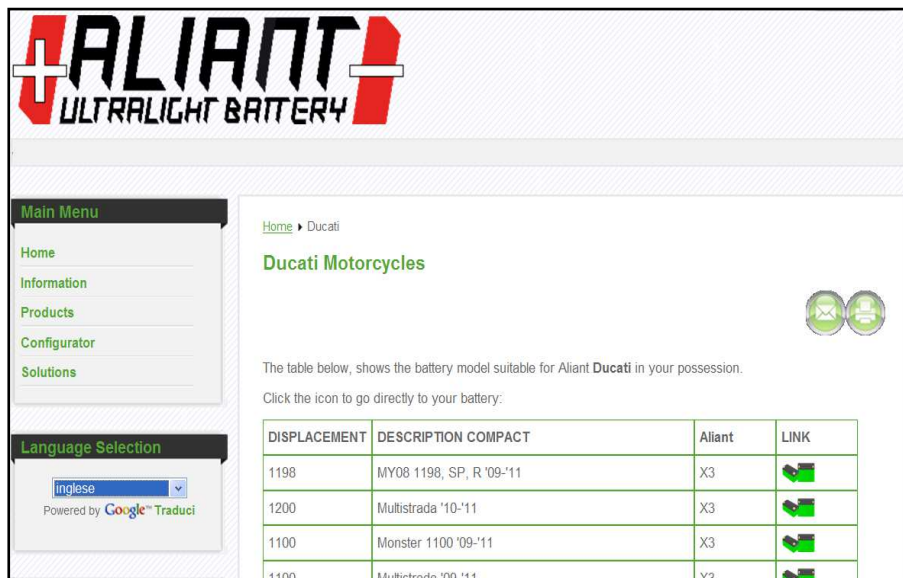
- **Safety:** the lithium phosphate cells have a strong chemical bond, therefore, in the case where the operating conditions are not complied the oxygen atoms are more difficult to remove. This stability of the reaction, in addition to stabilize the cell, also helps the energy transfer. ***We have developed Aliant batteries in order to ensure top quality and safety. The last two are priority for us. The LiFePO<sub>4</sub> technology doesn't explode or being fire if damaged, unlike the LiPO technology (mainly used in radio controller airplane).***
- **Quality :** the Aliant battery are equipped with the BMS embedded. ***The BMS (battery management system) is an electronic circuit embedded within the battery which balances the cells and ensure that everything is working properly. Differently from most of our competitors, we developed the entire project based on the BMS, so that cells work balanced both during the discharge and charge state. This electronic equipment increase the performance and the useful life of the battery.***
- **Power density:** as previously shown these cells are the best to develop a starter battery. The power/weight ratio isn't comparable to any other technology on the market. ***For example, a Yuasa YTX14H-BS (High Performance Maintenance Free) model supply 240A with 3,91 Kg of weight. The equivalent Aliant model is the X3, which supply 360A (10 sec. continuously) with 1,25 Kg of weight.***
- **Number of cycles:** the Aliant tested in the laboratory have a duration of 1000 cycles at charge/discharge cycles at 100% and 2000 charge/discharge cycles at 80%.
- **Rapid charging and low self-discharge:** less than 30 minutes for a full charge and a 8% month self-discharge providing a range unprecedented for Aliant battery. ***For the charging mode we suggest the Aliant CB1210 battery charger which supply 10A of charging current. Moreover, we have homologated other battery charges from some of the most important manufacturers.***  
***Check Aliant webpage to find the list of Approved Battery Charger: [www.go-aliant.com](http://www.go-aliant.com)***
- **Energy Density:** not the greatest strength of LiFePO<sub>4</sub>, however are still characterized by good values. ***The main requirement to start the engine is the high crank amps. Due to the high interest from electric motorcycles, bikes and energy application we are developing the energy product line of the Aliant battery, where high energy density is the priority.***
- **Maintenance:** the Aliant are maintenance free, does not require any particular effort. In case of long rest period we suggest to disconnect the battery from the vehicle - to prevent the electric system absorption - leading to a full discharge which means a reduced battery life.

### 3 BATTERY CHOICE

Aliant batteries X and X-P series are designed and manufactured to suit most applications. We provide two different series - **X and X-P** - with a **desired overlap (models X2 and X3 and X2P and models X3P) of electrical features and weight, but not in size.** In fact, our goal is to satisfy the different sizes of the battery compartment. Step by step guide to choosing:

#### A) SEARCH BY A VEHICLE :

Motorcycle / quad / atv / utv / scooter battery selection: Consulting the online configurator on Aliant website and identify which Aliant model battery we indicate for your vehicle. The configurator match each Aliant model to a vehicle. If you find N/D, unfortunately there is no Aliant battery replacement. Ask to your dealer concerning the right Aliant battery for your vehicle.



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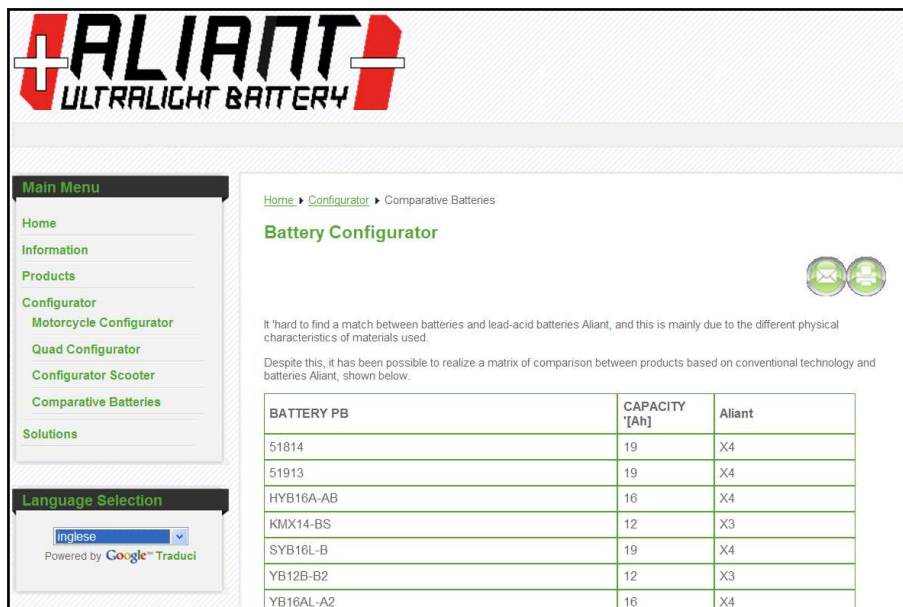
### Ducati Motorcycles

The table below, shows the battery model suitable for Aliant **Ducati** in your possession.  
Click the icon to go directly to your battery:

DISPLACEMENT	DESCRIPTION COMPACT	Aliant	LINK
1198	MY08 1198, SP, R '09-'11	X3	
1200	Multistrada '10-'11	X3	
1100	Monster 1100 '09-'11	X3	
1100	Multistrada '09-'11	X3	

#### B) SEARCH BASED ON A TRADITIONAL EQUIVALENT BATTERY :

known the old battery we suggest to consult the "Battery Configurator" table and look for the model of your traditional battery linked to the corresponding Aliant. If the traditional model of battery is not present, ask to your dealer concerning the right Aliant battery for your vehicle.



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### Battery Configurator

It's hard to find a match between batteries and lead-acid batteries Aliant, and this is mainly due to the different physical characteristics of materials used.  
Despite this, it has been possible to realize a matrix of comparison between products based on conventional technology and batteries Aliant, shown below.

BATTERY PB	CAPACITY [Ah]	Aliant
51814	19	X4
51913	19	X4
HYB16A-AB	16	X4
KMX14-BS	12	X3
SYB16L-B	19	X4
YB12B-B2	12	X3
YB16AL-A2	16	X4

C) **ALTERNATIVE SEARCH** : If not applicable none of the above choices, consider mechanical dimensions and electrical features of the battery to be replaced. Precisely, recognize brand and model, electrical characteristics

(voltage V, peak current A and capacity Ah) and dimensions of the battery to be replaced. You must have all the information listed above to find an equivalent item.

**STREET USE:** For a daily use on a vehicle intended as road use is recommended to proceed with a battery having an Aliant capacity as shown in the table below.

**RACING USE:** for sports/racing it tends to exacerbate weight and size at the expense of all other factors previously stated, and in particular the number of starts and then the battery life. In these cases it is advisable to proceed with a battery having an Aliant capacity as shown in the table in the "Racing Use" line.

You should **ALWAYS** check that Aliant battery has to the capability to start the engine at least once when you make a choice based on "Racing use": the Racing Use choice is not guaranteed given the limited capacity and possible high compression rate engine.

Model	X2	X3	X4	X6	X8
<b>Equivalent Lead Acid battery</b>					
➤ Street Use	Up to 8 Ah	Up to 12 Ah	Up to 18 Ah	Up to 24 Ah	Up to 35 Ah
➤ Racing Use	Up to 12 Ah	Up to 18 Ah	Up to 24 Ah	Up to 30 Ah	Up to 50 Ah

Model	X1P	X2P	X3P	CUSTOM (>1000pcs)	
				X6P	X8P
<b>Equivalent Lead Acid battery</b>					
➤ Street use	Up to 5 Ah	Up to 8 Ah	Up to 12 Ah	Up to 24 Ah	Up to 35 Ah
➤ Racing Use	Up to 7 Ah	Up to 12 Ah	Up to 16 Ah	Up to 30 Ah	Up to 50 Ah

**Sample selection:** Search Yuasa Battery equivalent to BS-YTX14H.

	Brand	Model	Voltage	Capacity	Dimensions (mm)
	Yuasa	YTX14H-BS	12 V	12 Ah	L150 x P87 x H145
Street use	Aliant	X3	12 V	6,9 Ah	L148 x P67 x H112
Racing use	Aliant	X2	12 V	4,6 Ah	L148 x P67 x H85

With Aliant the polarity terminals of the battery is **exclusively** with positive pole on the left - front side viewing -, to mount the batteries on the vehicle ready for the positive pole on the right should simply reverse the direction of assembly of the battery compartment - rotating through 180 ° - so you can connect the red wire to the + positive battery terminal and the black wire - to the negative terminal. In case of any doubt, please contact your dealer or official distributors.

## 4 BATTERY CHARGERS

Each Aliant battery requires the appropriate battery charger, it is essential, as previously seen for a lithium battery, because is composed by cells with different nominal voltages compared to



the lead solution. Therefore it is recommended that you use the Aliant battery charger to recharge the Aliant batteries, disconnecting immediately after charging is completed or when overheated battery. **Use of other chargers intended for traditional batteries can: not guarantee the proper charging of the cells, decrease its useful life, damage, and even cause them to explode, especially if the charger is used with a desulfation cycle.** *Moreover, some battery charges do not have the desulfation mode and can recharge without any damage the Aliant lithium battery, but some of them do not complete the charger till up 100% caused by a lower charging voltage. We frequently test new chargers in order to expand the homologated battery chargers list.* *Check Aliant webpage to find the list of Approved Battery Charger: [www.go-aliant.com](http://www.go-aliant.com)*

## 5 MAINTENANCE AND SHELF LIFE

The batteries Aliant require a very limited maintenance. If possible, keep the battery charged, or recharge it when the beam power is reduced, the horn is weak, or the battery has not been used for more than **three / four weeks**. Also, run this simple list of operations periodically:

- Check cables, clamps, and if there are obvious damage or loose connections;
- Clean terminals and connectors if necessary;
- Recharge the battery with appropriate charger every 3-4 weeks, if the motorbike is left still for long periods without disconnecting electrical wires, we suggest to start the engine and leave it on a few minutes;
- Use a battery maintainer (only use homologated type, see chapter 4)
- **If you disconnect the battery from the power of the motorbike,** you still need to make a periodic charge every 3-4 months, and especially to fully charge the battery before restart the vehicle;

If the vehicle is in the garage or rarely used, **it is advisable to disconnect the battery cables** in order to eliminate the discharge due to electric system absorption. In case of prolonged storage (eight / ten months) recharge the battery to 100% (**at least once every three/four months**) then check the battery voltage with a voltmeter or check it through the charger display – the terminals voltage will be about 14.6 V.

## 6 LOW TEMPERATURE PERFORMANCE

Lithium cells' performance are affected by temperature, especially when the drop below 5°C: this is due to the reduction in chemical activity and the increase of the internal resistance of the battery at lower temperatures. However, also lead acid batteries are sensitive to cold temperature, but with minor effects.

Aliant batteries do not make exceptions on this, but there is an important procedure to be followed in order to help the battery crank up the engine also during winter season.

The discharge behavior vary for each battery system, design and discharge rate, but generally best performance are obtained between 10 and 60 °C.

Cold start procedure:

- 1) Make sure the battery is fully charged
  - a. If you have not used the motorbike for long time, then you should charge the battery up to 100%
  - b. Do not try to start the vehicle with the charger working and connected to the battery terminals
- 2) Switch on the vehicle electric system with the key
- 3) Leave the motorbike turned with engine stopped for 30 sec

- 4) Try start the engine
- 5) If the engine cranked up, then you are ok
- 6) If the engine did not crank up, wait: leave the electric system turned on, and eventually switch on the Beam Lights
- 7) Wait a 3-4 minutes: in this phase you are actually heating up the lithium elements
- 8) Try cranking up the motor again
- 9) If the engine cranked up, then you are ok
- 10) Otherwise repeat step from 6 to 9 once again
- 11) If the engine did not cranked up, then you should recharge the battery again

If you need more information about the cold temperature performance, ask you dealer or contact Aliant official distributor.

## 7 ALIANT BATTERY GENERAL INFORMATION

### **Aliant, always ready to go ...**

Aliant has a daily self-discharge less than 0.3%, therefore a complete discharge from 100% to 0% takes approximately 1 year under ideal conditions (if disconnected from the vehicle's electric system!) ...In practice, even after long rest period you have a good chance of finding the battery charge! There will not be deprived, during a public holiday, of your favorite hobby pleasure because of a run-down battery... and if Aliant capacity is low, you have to recharge it with his recommended charger and in less than 30 minutes you can easily restore and start your bike, or any other vehicle! However, we recommend charging - also partially – the battery during long rest periods, to prevent the absorption of the bike can fully discharge the battery, shortening its useful life.

### **Aliant, no changes to the electrical system of your bike ...**

Aliant does not require any modification to the electrical system, you simply need to replace the existing battery with the Aliant suggesting by the configurator on our website. The electronic battery management manages and integrates it, loading it automatically through the alternator and providing the necessary energy to starting and maintaining services (lights, fans, ...).

### **Aliant, finally the longer life for everyone ...**

Actually, lithium cells provide the best longer life battery: laboratory tests and experiments carried out in collaboration with University of Bologna and other R&D laboratories of the main motorcycle/ulm/car manufacturers show this features. The average Aliant batteries life translates in a useful life of approximately 5 years. In practice, buying an Aliant battery, the raised cost is paid off in terms of greater life and greater durability.

### **Aliant, safe and reliable ...**

Aliant is a battery made with innovative material of the best quality. The cells used (lithium iron phosphate) are safer and with a quality control exceptional: starting from the checking of the same cells until the end of production process.

### **Aliant, ecological and environmentally friendly ...**

Aliant battery is compatible with the RoHS standard, it does not contain harmful elements to the environment. The total absence of heavy elements such as lead or e acidic solutions, typical of traditional batteries, is a great honor and a sign of respect for nature and the environment in which we live. The environmental footprint of these batteries is limited, the materials are recyclable plastic housing: think about the environment before choosing the next battery.

## 8 SAFETY REQUIREMENTS

The guidelines UN / DOT (United Nations / U.S. Department of Transportation) define the requirements for testing for the transport and packaging of batteries and accumulators. Lithium cells and batteries must comply with the requirements in section 38.3 of the "UN Manual of Tests and Criteria" (UN / DOT Transportation Testing).

One of the major risks associated with the transportation of batteries and equipment with battery power supply is the battery short due to contact of the terminals with other batteries, metal objects or conductive surfaces. Consequently, this carriage is subject to very strict standards, which have been harmonized at international level.

Any lithium ion batteries with energy greater than 100 Wh is classified as a CLASS 9 - MISCELLANEOUS DANGEROUS GOODS (Class 9 - Miscellaneous dangerous goods) according to the rules on the transport of dangerous goods by road (ADR) and by air (IATA & ICAO). This is not only the transfer of the batteries from the manufacturer to the dealer, but also all forms of transport such as for example the return of a defective battery by the consumer to the dealer or the dealer to the supplier. Instead, the lithium batteries with energy less than 100 Wh are not classified as dangerous goods.

Sometimes a manufacturer may request the return of a defective battery for analysis, but if the battery poses a risk to public safety, transportation is prohibited by the following special provision: "It is forbidden to air transport of Lithium batteries identified by the manufacturer as defective for safety purposes, or who have suffered damage, and are potentially capable of developing a dangerous level of heat, fire or short circuit. "

CLASS 9 shipping goods in the category means that the battery should be tested in accordance with the Manual of Tests and Criteria A, Part III, subsection 38.3.1 shall also be complied with specific procedures for handling, packaging, labeling and shipping. The Aliant batteries are suitable for transport studies conducted on lithium cells used.

Regulations for air transport and road of lithium-ion batteries are very similar and the same rules regarding the limits of Wh and labeling and documentation requirements that apply to air transport are also valid for goods transported by road .

The normative above mentioned are both for individual and equipped battery:

### 1) Individual battery shipment

Shipment specification has to respect the freight condition as defined in UN 3480. Furthermore, the airplane shipment rules are the PI 965 CHAPTER 2.

### 2) battery shipment inside equipment

Shipment specification has to respect the equipment bounds.

### Summary

The batteries with capacity till up 100 Wh (Aliant X3 and Aliant X3P) have to follow the following normative:

TRUCK	ADR	NO RESTRICTION	
AIRPLANE	IATA	PI 965 SEZ.2	

Batteries with capacity up to 100 Wh (Aliant X4, X6 and X8) are classified as goods IMO Class 9, that means miscellaneous dangerous goods therefore are required dedicated transport.

TRUCK	ADR	188	
AIRPLANE	IATA	PI 965 SEZ.2	

It is mandatory to stick each carton box consisting of different pieces of batteries with the right label, as show the following picture:



**We always suggest to contact your forwarder in order to check shipping regulations and technical specifications of batteries and packaging constraints, as the may change based upon forwarder.**

## 9 FAQ

### 1 It must change in some way the vehicle in order to install this type of battery?

No, Aliant battery is perfectly suited to replace the battery already present on the vehicle - either lead, AGM, or any other lithium battery.

### 2 What happens when the battery is fully discharged Aliant?

Nothing special, just use the charger to recharge the battery.

### 3 How to use the battery during periods of inactivity?

The battery should preferably be disconnected from the vehicle when not in use (you can also disconnect a cable, or install a master switch for the battery / isolator). In fact, if you do not disconnected the battery from electrical vehicle, it shortens the span life due to the current absorption of the electrical part: not forget that every vehicle, in fact, is never completely extinguished. A middleweight motorcycle, for example, has an absorption zone estimated at 2-5 milliamps per hour, which in practice helps to draw approximately 1.5 to 3.6 Ah per month ...Therefore, the maintenance of the battery is no longer necessary, but it is IMPORTANT disconnect the cables of the vehicle from the battery terminals. If you do not, you run the risk of damaging the battery.

### 4 How powerful a battery Aliant?

Our batteries are more powerful than those that lead is replaced, so the engine will turn more quickly and reliably. In practice, the starting current of a battery Aliant is always greater than the corresponding value of the battery replaced and will have no problems to make the starting of the internal combustion engine.

### 5 Can I leave my car for an entire season in the garage and turn it on in the hope that it sets in motion the first try?

We can't guarantee that this happens! But we can say that there are two factors that benefit a lithium battery in comparison with the lead: The limited self-discharge - the value of self-discharge is less than 0.3% per day-so the

battery when fully charged has a range of about 1 years - if disconnected from the electrical system. The best behavior as a function of temperature and lack of memory effect - contribute to the increase chances...

#### **6 Because the capacities indicated for Aliant battery is smaller than the lead acid batteries that replace?**

The lithium-ion technology we use is able to produce more current from a smaller quantity of material in contrast to the chemical reaction lead-acid, therefore, makes the same peak current with less Ah (Ah) - and the battery is smaller and lighter. In addition, the problems described in the section of the lead acid battery does not occur in the technology of LiFePO<sub>4</sub> thanks to the chemical bond Fe-PO very strong stabilizing the cell and helping the energy transfer allows to realize battery with nominal capacity much lower than those of a lead-acid, with discharges up to 95% of its rated capacity and average life of 2000 cycles. The previous result is a completely unthinkable for a lead acid battery which contains a nominal capacity of more than twice a LiFePO<sub>4</sub> with the restriction not to exceed 50-55% of the download to start. All this translates into a greater charge density in lithium batteries compared to lead.

#### **7 It is possible to mount the battery on its side?**

Aliant batteries can be mounted in any position - that is tilted upside down: this is possible due to the absence of any liquid inside. It is recommended to keep the battery away from drains or from other sources at high temperature to avoid heat them. Moreover, even in the case of batteries Aliant is made of plastic material - such as that of a traditional battery - therefore the direct contact with metal parts that they reach a temperature > 120 ° C can cause problems.

#### **8 How do I order the battery with reversed polarity - the positive terminal on the right?**

All batteries Aliant have the positive terminal on the left - and you can order products with variations on this layout. This is NOT a limit, in fact, the compactness and small size allow you to mount the battery by turning on itself through 180° and taking the positive side you want, connecting properly to the electrical system of your vehicle.

#### **9 Can I use a conventional battery charger?**

We supply the CB series battery charger to recharge the Aliant battery. CB series battery chargers are able to charge 100% in the minimum time every Aliant batteries. However, these CB chargers are not maintainers and should not being kept switched on for long time. If you need a maintainer, then you choose among one of the homologated models.

**Check Aliant webpage to find the list of Approved Battery Charger:** [www.go-aliant.com](http://www.go-aliant.com)

#### **10 We need a maintainer for the winter or for long periods of inactivity?**

You do not **need** no maintainer, however you can use a maintainer. The limited self-discharge, together with the lack of memory effect, the battery will help to overcome long periods of inactivity. It's important, however, disconnect the battery terminals from the vehicle, which otherwise will continue to absorb even a small current to the electric off, with the risk of getting the battery and significantly reduce the useful life. If you have an immobilizer or anti-theft device, then you might need not to disconnect battery cables: in these case, you need to use a maintainer because otherwise your vehicle's battery will be totally discharge in less than two weeks.

TYPICAL 600 4CYL MODERN MOTORBIKE				
BATTERY	YUASA YTZ10S (8.6 Ah)	ALIANNT X3 (6.9 Ah)	YUASA YTZ10S (8.6 Ah)	ALIANNT X3 (6.9 Ah)
	W/O IMMOBILIZER		W/ IMMOBILIZER	
CURRENT DRAIN:	5-10 mA		25-30 mA	
DAILY DRAIN:	0.12-0.24 Ah		0.6-0.72 Ah	
WEEKLY DRAIN:	0.84-1.68 Ah		4.2-5.04 Ah	
MONTHLY DRAIN:	3.66-6.72 Ah		16.8- 20.16 Ah	
W/O MAINTAINER YOU NEED TO CHARGE THE BATTERY EVERY	6-10 WEEKS	5-8 WEEKS	<b>1.7-2 WEEKS</b>	<b>1.4-1.6 WEEKS</b>
WITH MAINTAINER	NO PROBLEM, CHARGING IS FLOATING		NO PROBLEM, CHARGING IS FLOATING	
IF YOU DISCONNECT CABLE YOU NEED TO CHARGE THE BATTERY EVERY	6-10 WEEKS	12-16 WEEKS	5-8 WEEKS	12-16 WEEKS

#### 14 How should you dispose of these batteries?

In general, depends from country to country and from municipality to municipality.

Aliant batteries are complying with RoHS regulations, because they do not contain any of the "harmful" materials. ELSA Solutions has already joined the Recycle Consortium as for European Regulations, therefore the consumers can simply go to the nearest collection point of batteries and exhaust the Aliant battery without any additional cost. If this is not possible, we recommend you contact the local municipal company and request information about, or visit your nearest battery retailers.