

## **BikeMaster TruGel Battery 101**

BikeMaster has been working with the factory on this technology for years, and in fact they developed the first gel motorcycle battery in the world in 2004. Since then, there has been a tremendous amount of research and development, with a lot of refinement to make these batteries function with the variability of motorcycle charging systems... After all, we are asking for the battery to live in very different worlds... Some motorcycles sit for months without use and this does its own damage to the battery. Others are asked to tolerate up to 14.7 volts (the highest output of the charging systems when the engine is turning high revolutions...) for extended periods. This means that the battery must be very tolerant of over charging, under charging, high temperatures, low temperatures, high frequency vibration, low frequency vibration, high G impacts (Off Road and ATV), and everything in between.

So, how does the BikeMaster TruGel battery meet all these myriad challenges? And if you could design a better battery, what would you want it to do?

### **Durability:**

You would want it to be durable, and survive the pounding and vibration of on and off road use in motorcycles and ATVs... And this is one of the areas where a BikeMaster TruGel battery really excels. TruGel Electrolyte with Nano-Gel Technology, because of its viscosity, will not flow nor leakage, and makes batteries safer than ever before. Even if the outer case were to crack, the Nano-Gel would not leak like a regular water acid based battery. In fact, we've seen these batteries continue to function with no apparent reduction in ability with holes drilled into the case!!!

### **Deep Cycling:**

Deep Cycling is where the battery is discharged deeply, and then recharged again. You need a battery with the ability to recover from extended discharges time and again. You would also want the battery to survive long periods of inactivity, something that has been a KILLER of standard (wet) water based batteries... This is due to the fact that over time, the acid in the battery suffers from stratification. This is caused by "precipitation" of the sulfides in the liquid (they form crystals adhering to the plates, and building resistance), thus causing Sulfation of the Negative Plates, and Corrosion of the Positive Plates, leading to the DEATH of the battery. This also leaves the liquid in the battery in a weakened state, almost back to being water... Thus there will be very little electricity generated in the top "Weak Acid Zone", and very little charge generated in the "Sulfated Zone". And when you add in the evaporation of water from a standard battery over time... Well, what you get is a battery that barely has enough charge to light the dash lights... And will only make the starter solenoid "click" without sufficient current (cranking amps) to start the engine (We know you have been there! :-))

But, because Nano-Gel Electrolyte is very high in viscosity, the sulfides are "rigidly" held in suspension, and therefore acid stratification will not occur to the same extent, hence we can avoid the Sulfation to the negative plates and corrosion to the positive plates (at the bottom of the plates due to high acid specific gravity). Because the battery maintains 100% acid concentration, in 100% of the electrolyte, 100% of the time, the ability to use all of the electrolyte and plate surfaces, not only increase the efficiency of the battery when new, but will increase it's ability compared to a standard water battery, AND result in a very much extend battery life span.

### **Extreme Temperatures:**

Obviously, you would also want a battery that functions well in the cold environments of the North of our country... And BikeMaster TruGel Batteries perform very well in a cold environments, the battery working limit has been extended to -40°C (-40°F). Far colder than anyone we know wants to ride! :-)) Except for my snowmobile buddies in the Great White North...

Likewise, you would also want a battery that functions well in extreme heat too... Which here in Texas is a necessity. Again, a BikeMaster TruGel Battery by its very nature performs very well in a hot environment. Even in an environment with 50°C (122°F), the life span of a Bike Master TruGel Battery is double that of a conventional water battery.

Because of the above mentioned efficient utilization of the electrolyte and plates, the capacity of the battery is increased. Looking at the performance curves, the fall off of the performance is much extended. This is especially true at the later stages of the standard water battery's life, where the capacity is lowered dramatically by the loss of fluid due to evaporation in the hot environment. Therefore, the BikeMaster TruGel Battery gives not just a longer life, but a higher plateau for longer in working capacity overall, but especially so in high temperatures.

### **Self Discharge Rate:**

You also want a battery that when not used frequently has a low self discharge rate. Again, BikeMaster TruGel batteries excel in this area. Because Nano-Gel Electrolyte will help to reduce the rate of negative plates sulfation, and therefore greatly reduces the battery self discharge rate, hence it will increase the shelf life, extending it far beyond that of a standard water battery... In fact, the battery will be able to start a motorcycle after one year (or more) sitting on the shelf. This will be a huge advantage for dealers, who can order and not worry about having to constantly keep their inventory charged, or order less, or have dead batteries... It's an advantage for Tucker Rocky as a distributor, in that they can ship batteries with far more confidence, and order quantities that make sense for them, not based on shelf life. AND, it's an advantage for the customer, who can buy with confidence knowing that the battery will have the power, and a life span that will far exceed the other batteries he has purchased and replaced time and time again, that are based on water...

### **Recombination:**

Can I get a bit technical here? Would you like to hear about recombination? Of course you would! :-))))))

A standard lead-acid battery is an electrical storage device that uses a reversible chemical reaction to store energy. It uses a combination of lead and lead oxide plates or grids, and an electrolyte consisting of a diluted sulfuric acid (H<sub>2</sub>SO<sub>4</sub>, @ about 35% concentration) to convert electrical energy into potential chemical energy and back again. It does this because when the two plates (the lead and the lead oxide) are immersed into the acid solution, two things happen. One, the lead plate is forced to release protons into the electrolyte, and this leaves it in an electron rich state, or negatively charged. Two, the lead oxide plate is forced to release electrons into the electrolyte, and this ends up with more protons, and this is positively charged. When you connect a load to the battery, say a starter, the electrons from the negative (lead) plate try to rush over to the positive plate (lead oxide) to balance the plates out...

The loading of the battery and this flow of electrons causes the formation of lead sulfate in the electrolyte, which is deposited on the plate surfaces (almost like a Sulfate Electro Plating). The "ate" in sulfate is oxygen which is stripped from the water in the electrolyte, and once stripped from the water, it leaves free Hydrogen as a gas to escape from the battery... So, when you apply a charging current to the battery you reverse all this process, and the result is that you need oxygen to "recombine" with the hydrogen. All of this to say that...

Because TruGel Nano-Gel Electrolyte has a "three dimensional" lattice structure (because the gel is made using Silica to stiffen it, which has a "lattice structure", during the charging process, it will guide the generated oxygen horizontally toward the negative plates where the recombination process occurs with the generated hydrogen, which in turn reduces the moisture loss, and increases the sealed performance, and thus battery life.