

Battery Heirachy

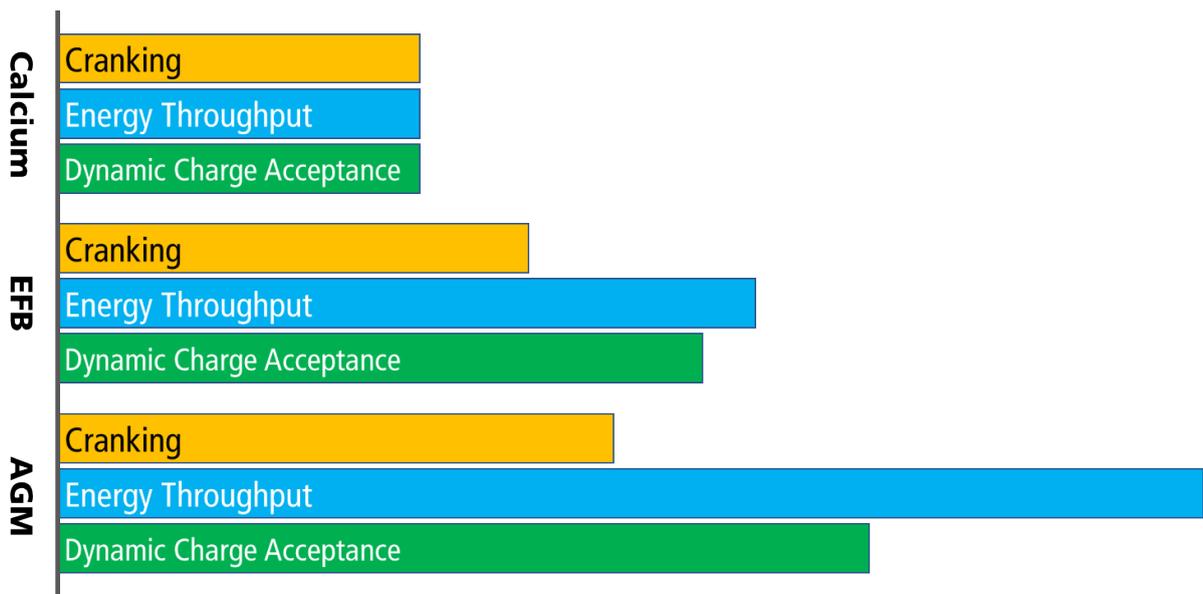
There are three main types of automotive batteries currently being used in vehicles.

The most common battery is the Maintenance Free Calcium battery. This battery is a flooded design which has small amounts of calcium added to both positive and negative grids to improve durability and reduce water consumption.

Absorbent Glass Mat (AGM) batteries are different to the Calcium battery in a number of ways however the chemical reaction is the same. AGM’s use a compressible glass mat to separate the positive and negative plates in the battery; this mat also holds the electrolyte required for the battery to function. During assembly, the plate and mat assembly is compressed which enhances durability and vibration resistance. AGM batteries were an enabler for the development of Idle Stop Start (ISS) technology.

Enhanced Flooded Batteries (EFB’s) are the new kid on the block. EFB’s were developed as a more cost effective solution for ISS vehicles. They are based on the flooded calcium design which means that they can be manufactured in a factory which manufactures flooded batteries using the existing equipment. Enhancements to the base design results in increased charge acceptance and cranking power, as well as the ability to constantly operate at partialState of Charge.

The following chart compares the three key attributes required for ISS technology to function effectively – cranking power, energy throughput and dynamic charge acceptance.

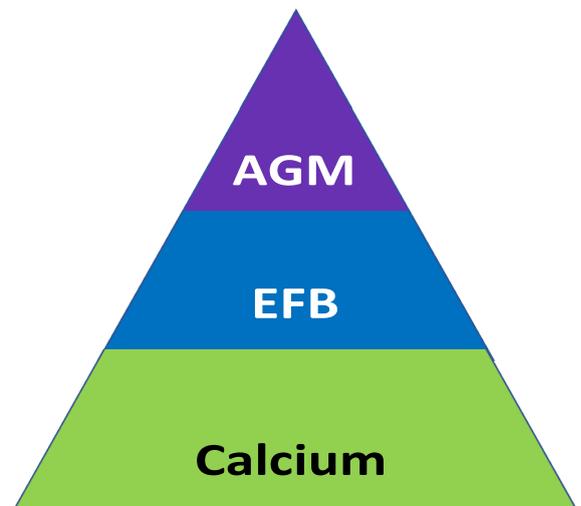


- **Cranking** refers to the amount of energy the battery can deliver in a short burst to start an engine. It is normally measured in CCA.
- **Energy Throughput** is similar to cycle life however it is a more definitive measure. Energy throughput is the amount of energy a battery can store and deliver over its lifetime. To explain how this links to cycle life; a battery which is rated for 1000 cycles at 20% DoD will be rated at around 500 cycles at 40% DoD. This equates to the same amount of overall energy being stored and delivered by the battery (i.e. $1000 \times 20\%$ is the same as $500 \times 40\%$).
- **Dynamic Charge Acceptance** is a measure which was developed to assess a battery's performance in a micro hybrid vehicle (ISS). In these vehicles, the battery is charged and discharged constantly, and is often subject to high charging rates depending on the battery SoC.

Another significant factor for flooded lead acid batteries is stratification. This occurs as the battery is cycled, and results in the electrolyte having a higher concentration of sulphuric acid at the bottom of the cell, and a lower concentration at the top (i.e. more water at the top). This higher acid concentration at the bottom of the cell means lower section of the plate does more of the work while also accelerating the rate of corrosion. A major advantage of AGM batteries is that they are not susceptible to stratification.

Upgrading

When it comes to upgrade options, the battery hierarchy looks like the triangle on the right. Calcium is at the base with EFB in the middle and AGM on top. In many fitments you can upgrade to higher construction type however you cannot downgrade. As an example, a customer has a vehicle which was originally fitted with a calcium battery however they want a higher performance solution.



Assuming the correct case size is available, you can recommend upgrading a Calcium battery to an EFB, or possibly an AGM. It is important that you never downgrade. If a vehicle was originally fitted with an EFB, downgrading to a Calcium will result in premature battery failure and will void the battery warranty.

When assessing an upgrade to an AGM battery, you need to consider how hot the battery will get in the installation location. Flooded batteries are able to shed heat more efficiently than AGM batteries as the electrolyte can transfer the heat to the outer case. It is also critical that if a battery heatshield is installed, it must be re-installed on the new battery.