Catalyst Life Extender

Technology Explained

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AUSTRALIA
1300 734 253
sales@valen.com.au
www.valen.com.au

NEW ZEALAND
0800 734 253
sales@valen.co.nz
www.valen.co.nz

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What is the Catalyst Life Extender?

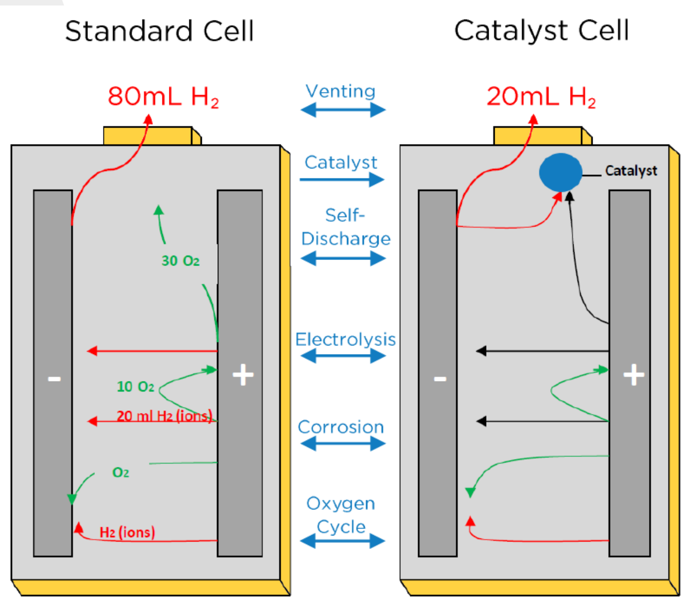
During the charge and discharge cycle of all lead-acid batteries, hydrogen and oxygen gasses are produced. The hydrogen escapes leaving the oxygen gas behind. This reaction causes the battery to sulphate and the plates to depolarise over time.

When a Catalyst Life Extender is installed in the headspace of a VRLA battery, it changes the electrochemical activity within the cell. This causes balance within the cell, preventing the negative plate from depolarising over time and improving cell capacity. A healthy balance in the cell will be immediately apparent by a reduction in the cell's float current by up to 50%. What this means is:

- A dramatic reduction by up to 80% in cell gassing
- Reduced water loss delaying cell dry out
- Reduced positive plate corrosion
- Reduced cell heating
- Reduced risk of thermal runaway
- A reduction in the energy required to cool the cells/batteries

Another essential feature of the batteries using a Catalyst Life Extender, such as Valen's ENDUROX-CEL and ENDUROGEL batteries, is that they can be used in temperatures of up to 30°C without the loss of life.

Gas Cycle of a Typical 100Ah VRLA Cell



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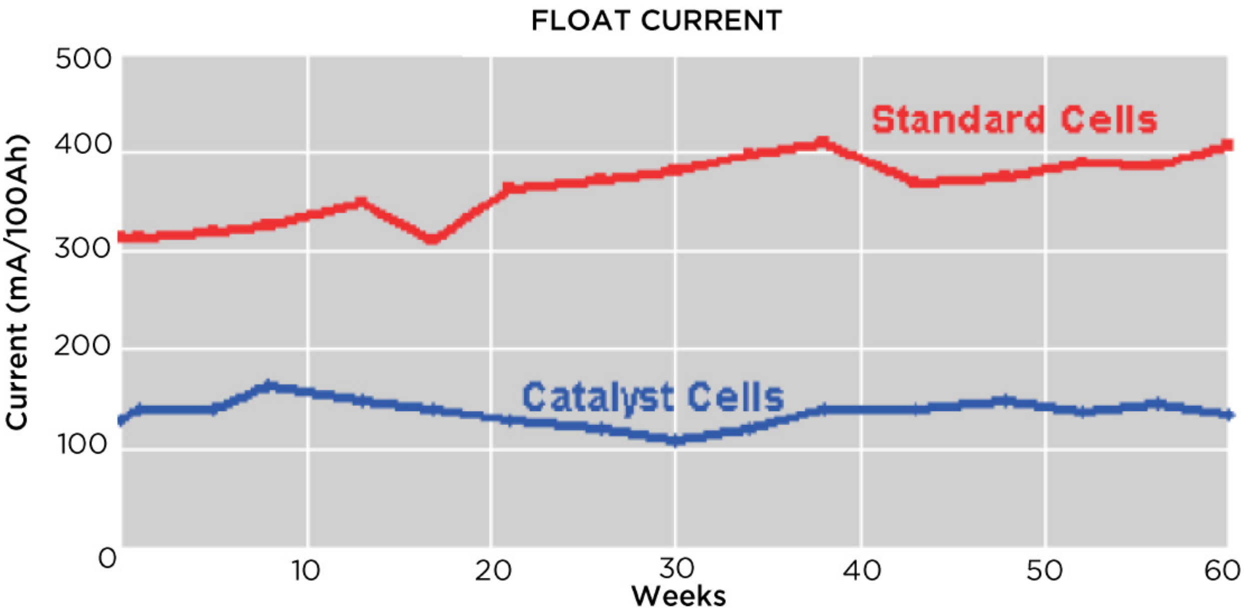
Benefits of a Catalyst in VRLA Batteries

The VRLA battery was designed to correct the problems of flooded technology. The gas inside the battery cell was meant to recombine back into the water, preventing the battery from dry out. In an ideal world, there would be no negative plate self-discharge, no positive plate corrosion, and no excess charge current needed. Batteries would last forever, and no gas would be released from the cell.

Chemistry dictates that negative plates do self-discharge, and they do this more when impurities are present in higher quantities. The typical high-quality, long-life VRLA cell has a self-discharge rate equivalent to 80mL of Hydrogen gas per day per 100Ah. Oxygen produced from a variety of processes on the positive plate will recombine with this hydrogen on the negative plate and cause it to depolarise.

When a positive grid corrodes at a relatively high rate, it absorbs the oxygen produced as the lead grid turns into lead dioxide, leaving no oxygen to depolarise the negative plate. This leaves an unbalanced situation with a strongly depolarised negative plate. The charging system will compensate with more current, which will lead to excessively high polarisation on the positive plate and damaging effects on the cell due to the excess current. Electrolysis will generate high amounts of gas, leading to water loss.

Adding the Catalyst Life Extender will allow the free oxygen to be absorbed in the headspace and recombined with the abundant hydrogen always present in the cell. This process drastically reduces the amount of gas venting from the cell, but most importantly, this prevents oxygen from reaching the negative plate and buffers the negative plate self-discharge reaction from the positive plate corrosion reaction.



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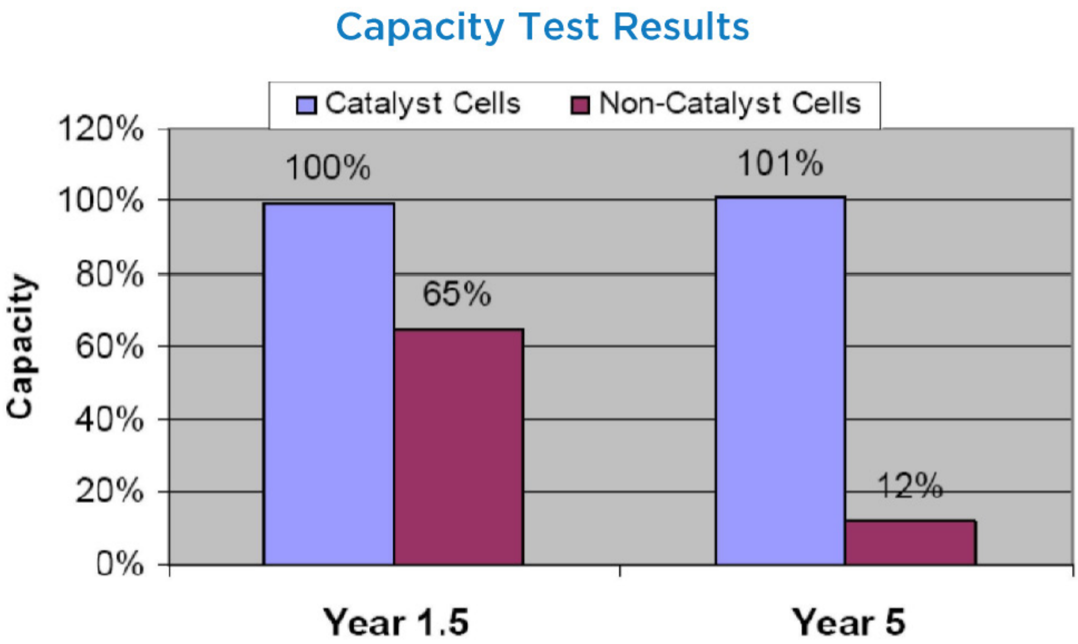
Philadelphia Scientific Testing

A definitive test was requested to compare 2 Groups, Catalyst Cells and Non-catalyst Cells, 6 cells each; this test was run for 8.5 years within the Philadelphia Scientifics lab. All cells were tested at 32°C and 2.27VPC. The batteries tested were high-quality 2V VRLA Cells.
Capacity Test Results



Catalyst Reduced Float Current

One of the most immediate observable effects of installing a catalyst in a VRLA cell is a sudden drop in the float current. Typically float currents are one-half or less when a Catalyst is installed. In a VRLA cell, the negative plate does double duty compared with a flooded cell. In addition to normal negative plate functions, it also is the site where oxygen and hydrogen are recombined into water, making the cell maintenance free. When this process is too efficient, excess oxygen reaching the negative plate causes it to become depolarised. When the negative plate is depolarised, the charging system will supply more current in an effort to bring the cell voltage up. The additional current becomes an excessive overcharge on the positive plate, which has many damaging effects on the cell.

Adding a Catalyst to the cell prevents some of the oxygen from reaching the negative plate and allows the negative plate to stay polarised. This means that less current needs to be supplied to the cell from the charging system, manifesting itself as lower float current, leading to the following benefits:

- Minimise Water Loss: gasses are recombined into water inside the cell rather than exiting the cell. Too much gas leaving the cell can lead to premature dry out and cell failure.

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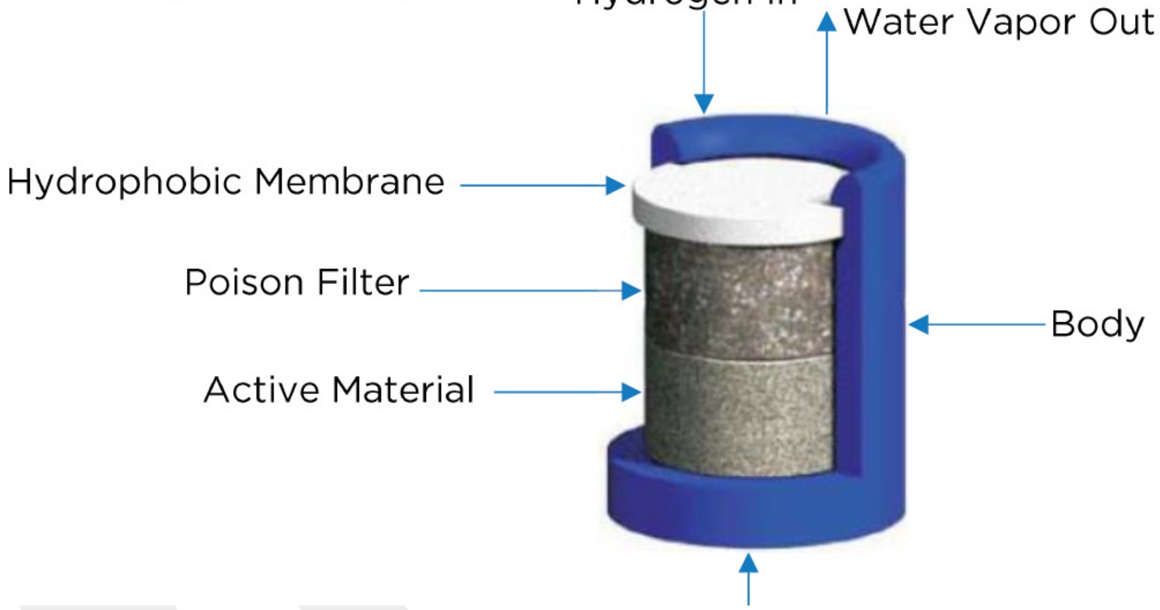
- Increased life: there are many potential failure modes of VRLA cells. A number of these failures can be mitigated by the Catalyst Life Extender technology, such as cell dryout, positive plate corrosion, thermal runaway, and capacity loss due to negative plate depolarisation.
- Minimise Positive Plate Corrosion: a reduction in float current reduces the amount of overcharge on the positive plate, which directly impacts the corrosion rate. The design life of a lead-acid cell is based on the corrosion of the plate barring any other unforeseen failure modes.
- Reduced Cell Heating: any excess current above that is needed to charge the cell is converted directly into heat. A reduction in float current means less heat is produced. This can result in a cooler environment for batteries and electronics or a reduced load on HVAC systems.
- Reduced Risk of Thermal Runaway: Since heating is reduced and float current minimised, there is less risk of thermal runaway.
- Direct Energy Savings: Reduced float current directly translates into less power purchased.

Anatomy of a Catalyst



- Body: Engineered high-temperature plastic outer casing. It can withstand temperatures up to 260°C. Chemically resistant to Sulphuric Acid.
- Hydrophobic Membrane: Microporous barrier allows cell gasses to enter the Catalyst chamber and water vapour to return to the cell. This acts as a barrier to keep acid spray outside the Catalyst. This also regulates the rate of gas diffusion so that the temperature never exceeds 93°C.
- Poison Filter: Guard layer of a dual-acting filter material protects the active material from poisonous gasses found inside VRLA cells.
- Active Material: Precious metal Catalyst dispersed on a granular substrate, which recombines Hydrogen and Oxygen into water vapour.
- Base: Can be custom moulded with a variety of different attachment methods for easy mounting on the vent cap.

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