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Author: Carl Luther

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Hydrogen Ignition

What causes a battery to explode?. When a battery charges the battery plates release gasses. The negative plate releases Hydrogen and the positive plate Oxygen. So it is important to remember that these two gasses are always present in varying volumes at various state of charge in the battery cell's upper compartment.

Vented batteries have vent plugs that allow the gasses to escape and it is therefore necessary to ensure that there is good ventilation anywhere batteries are fitted or stored. It is for the same reason that no smoking or naked flames are allowed in areas where batteries are stored or working.

Sealed batteries are designed with recombination technology, whereby the lids have a combination of channels and emergency vents with flame arresters that recombine the two gasses into water under normal conditions. The battery will however vent the gasses when the pressure inside the battery exceeds the acceptable working pressure for safety reasons. Therefore the same safety requirements are needed.

Hydrogen gas is extremely flammable and will ignite in the presence of a flame or an arc. The most common occurrence of sealed batteries exploding is due to batteries **running dry**. This will automatically expose the plates in free air that has a high concentration of hydrogen gas. If one draws or applies a high current to or from the battery, it could very easily arc across the exposed plates resulting in the ignition of hydrogen gas.

The resulting explosion happens as the gas will expand rapidly by 1000 times its original volume and expansion will burst the battery casing in order to release the pressure. The Hydrogen gas does not burn slowly like methane or LPG. The gas ignites and expands in a fraction of a second. The debris and acid spillage is the real hazard in this case. Thus the reason why we use safety glasses and PPE when working with batteries.

In order to prevent batteries from exploding one will need to focus on keeping the batteries from **running dry**. We know that excessive gassing is the cause of batteries running dry, so we need to control the gassing of the battery. This can only be done by controlling the **current** in the charging circuit. The initial charge currents are extremely important to ensure efficient charging of the product and though high will not cause excessive gassing unless the setting are incorrect. The most likely reason will be a too high float **current**. This current should never be higher than **0.01C** or **1%** of the rated C20 capacity of the product.

Hints

- Batteries must not be overcharged as they will run dry. Monitor float current. **VERY IMPORTANT!**

This current is normally controlled by the forward voltage setting on the battery charger. The recommended setting for most Lead acid batteries is 13.8 Volts @ 25° C or lower. This value needs to be temperature corrected for higher temperatures. What is most important is to ensure that the float current is monitored and to alert the system engineer if and when the current goes negative or exceeds 0.01C in normal float conditions.

When batteries are connected in series strings, they must be kept in balance at all times. When the blocks or cells go out of balance one will normally find that the float current will increase in the circuit. This will lead to batteries **drying out** over time. To avoid this from happening one must equalise the set on a regular basis as part of the maintenance program and one can install battery balance that can assist in both keeping batteries in balance and alerting owner to the fact that the set has gone out of balance. Note: **Partial charging** will most definitely result in balancing issues.

Conclusion: Batteries explode when the hydrogen is ignited. All batteries have hydrogen in the cell chamber. The chance for hydrogen ignition is highly increased when batteries **run dry**. Batteries run dry when they are **overcharged**, by incorrect charge settings or due to high float currents especially when cells are not balanced mainly due to lack of equalise charge. Batteries can also explode if naked flames are present. Do not smoke, weld or use naked flames near battery installations. Do not use batteries that have run dry. They must be replaced. Do not use a battery if any mechanical damage is detected.

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