FLOW SYSTEMS

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Battery Watering & Maintenance

Who is Flow Systems?

Flow Systems is a U.S. based manufacture of battery parts for the Industrial, Golf Cart, Solar, Wind Turbine and Scrubber battery industries. We offer a wide array of custom and off-the-shelf parts including vent caps, inter-cell shrouds, terminal shrouds, moss guard, single cell battery watering guns and soon to be released single point watering systems.

Flow Systems is most recognized for the Water Miser Safety Vent Cap which reduces battery water loss by up to 60% while drastically extending the life of your batteries. For further information, please visit us at www.flowsystemsusa.com or call us at 1 (843) 838-6699.

Why a Battery Needs Water?

It is important to understand why an industrial motive power traction battery used in electric material handling equipment needs watering, when and how it should be watered, what proper battery watering means and what advantages the Water Miser Battery Vent Cap offers over other alternatives.

Why an Industrial Motive Power Traction Battery Needs Watering

Loss of electrolyte is the primary reason an industrial motive power traction battery needs watering. Both heat and electrolysis are responsible for electrolyte level loss during the normal operation of electrically powered material handling vehicles and their support equipment (battery and battery charger).

Electrolysis and the Gassing Process

One of the main processes responsible for both the loss of electrolyte level as well as the loss of electrolyte itself is electrolysis. Electrolysis results from an electrical current being passed through a medium, in this case the electrolyte, creating a chemical change to the solution. This chemical change, in turn, causes a battery to "Gas".

Gassing of industrial lead-acid motive power traction batteries is basically a function of, and directly related to, voltage and the unused portion of current being supplied by the charging equipment and

subsequently not being utilized by the cell(s) via the positive and negative plates. This electrical disassociation or decomposition of the electrolyte into hydrogen and oxygen is a direct result of the surplus charging current.

Gassing generally begins, when the voltage of the cell(s) reaches approximately 2.3 volts. During this early stage, the gas is composed of nearly equal parts of oxygen and hydrogen. As the charging progresses, and the voltage rises to 2.5 volts per cell, the gas now will have a ratio of two (2) parts hydrogen and one (1) part oxygen.

As the battery gasses during the charging cycle, as previously mentioned, two basic factors are involved in the loss of electrolyte level within the battery cell(s)

a) Through the electrolysis process, hydrogen and oxygen are being evolved as gasses at the expense of the electrolyte and pass into the immediate and surrounding atmosphere - thus lowering the electrolyte level.

b) As the gasses are released, they become the vehicle for transporting millions of microscopic electrolyte (Sulphuric Acid) droplets from within the cell(s), through the vent-caps, and into the surrounding atmosphere and workplace - again, adding to the depletion of the actual electrolyte and lower levels within the cell(s)

With Water Miser Vent Caps in place, there is a minimal amount, if any, loss of the sulfuric acid (H_2SO_4) from the water/electrolyte solution. As a result, **routine "EQUALIZATION" of the electrolyte solution is eliminated**. The Electrolyte specific gravity will remain as originally intended assuring the rated capacity throughout the batteries useful life. Again, by placing Water Miser Vent Caps on a battery, one of the primary battery maintenance activities will be alleviated.

Note on Explosions - It is extremely important to note that during the recombination of hydrogen and oxygen, this intermediary gas is extremely flammable. It must be noted that any open flame or spark, regardless of how it is generated, can be the catalyst to trigger an explosion.

For this reason, open flames of any kind in a location dedicated to battery charging, should not be permissible, and sufficient ventilation should be in place to assure that the hydrogen level remains well below four percent (4%)

Other Factors Effecting Water (Electrolyte) Loss

There are a number of other factors that directly affect electrolyte level loss through heat related evaporation. Some of these are controllable, others are not. The following is a list of six key factors that contribute to electrolyte level loss:

- **Evaporation from Internally Generated Heat** - Internal Heat is generated and rises slowly throughout the normal discharge of the battery during the required work cycle - this has to be accepted.
- **The Work Load** - Directly affects the amount of heat generated. Light loads, short runs and frequent periods of inactivity will be responsible for less heat buildup than heavy loads, long runs, high vertical lifts and constant activity. The temperature rise will be greater as the rate of discharge is increased.
- **Ambient Temperatures** - as well as seasonal climactic heat variances greatly affect the battery's internal heat buildup -a cooler operating environment, applicable also to the charging station location, definitely will be a controlling factor in restricting elevated temperatures.
- **Unavoidable Heat** - is generated as a result of the charging cycle - the greatest increase is towards the end of the cycle, and never should the internal temperature exceed 115 degrees Fahrenheit. When a critical temperature in the area of 120 degrees Fahrenheit is reached, the charging current becomes unstable and may at times rise out of control to the detriment of both battery and charging equipment.
- **Mismatched Batteries and Charging Equipment** - Mismatched battery and charging equipment regulation can certainly be responsible for contributing to elevated temperatures.
- **Use of Batteries During Multiple Worker Shifts** - Use of batteries, without a sufficient cool-down period can place batteries in a potential temperature danger zone. The heat generated during the charge cycle immediately following the termination of the eight hour work/shift cycle will in most instances elevate internal battery temperatures to an unacceptable level.

When to Water a Battery

Now understanding the combined depleting effects of evaporation via heat and gassing via electrolysis relative the electrolyte levels and loss, the area of when to water a battery can be addressed.

- **Visual Check** - Prior to and before starting the charging cycle, each individual cell should be visually checked to assure that the electrolyte level is at least above the separator protector - at this point, how much above is not important.
- **Add Water** - If the visual check indicates that the electrolyte level is below the separator protector, and i s not readily visible, sufficient water should be added to bring the level approximately 1/4 inch above the protector.
- **Are Water Levels too High?** - When electrolyte levels are excessively high, or when the cells have been overly watered prior to the charging cycle, pumping of the electrolyte will occur due to expansion of the electrolyte. This expansion, as previously discussed, is a combined effect of both heat and gassing. This pumping action can be a major cause for loss of electrolyte which is forced out of the cell(s) and exits through the vent-cap(s) - if allowed to continue over a period of time, battery capacity and efficiency can be affected.
- **Begin Charging** - Once electrolyte levels, and temperatures, are deemed satisfactory, the charging cycle may be initiated.

- **After Charging** - At the termination of, and immediately following the charging cycle, the electrolyte levels are at their greatest volume, height within the cell(s), due to the combination of gasses being temporarily trapped within the cell element(s) and expansion due to heat generated during the charging cycle. If, upon inspection, electrolyte levels are below the cell cover vent-well extension tube, consideration must be given to watering the battery at that time.

How to Water the Motive Power Industrial Traction Battery

- Immediately after taking the battery off charge, check electrolyte levels in each cell. Cells toward the center of the battery tend to require a bit more water, due to heat retention as a result of isolation, than do cells located adjacent to the outside of the battery tray assembly where cooling becomes more effective.
- Each cell should be checked and if necessary, the levels adjusted to just touch the bottom of the cell cover vent-well extension tube - no higher and no lower
- Following the procedures outlined, and understanding the effects of heat and electrolysis relative to electrolyte expansion, the industrial motive power battery can now be properly watered using any of a number of automatic single cell fillers presently on the market.

What Proper Watering Means to the Battery

- With proper watering, the potential of pumping due to overfilling is eliminated - electrolyte is maintained within the cell(s) assuring voltage and capacity integrity through electrolyte stabilization - the necessity for flushing and washing the battery now becomes less frequent.
- Since pumping has been eliminated, the only moisture accumulation relative to the battery and battery cell covers will be from the normal flow of electrolyte laden gasses via the vent-cap vent(s) - which at times can be considerable.
- Cell to cell and battery to equipment body-grounding is greatly reduced with the elimination of pumping, but still remains an area of concern since vent-cap design has never totally addressed this critical area.
- Less Damage through the corrosive effects of the electrolyte to the battery, the material handling and charging equipment, the designated charging area floor as well as any support or inventoried material within the vicinity.