



JFM Engineering, Inc.

The Importance of Water Leveling

1. Water consumption

- 1.1 Nickel-Cadmium cells consume water as a normal part of their activity.**
- 1.2 Water is consumed as a result of the in-flight charge process and when current is demanded from the battery as it occurs with the starting of engines or the APU.**
- 1.3 The amount of water consumed is a measure of the activity of the battery.**
- 1.4 When water is consumed beyond the levels given by the manufacturer of the battery, it is an indication that the battery must be serviced more frequently or that there is a possible electrical problem in the aircraft (overcharging).**
- 1.5 If the battery is allowed to function with water levels below the minimum specified electrolyte level, then, in-flight battery overheating will be experienced. This in turn will contribute to an accelerated deterioration of the cell separator material and eventual cell failure.**
- 1.6 When cells are operating with less than the minimum required electrolyte level, the active area of the plates is reduced hence forcing current over a smaller area (higher current density) resulting in an overheating of individual cells or the entire battery.**
- 1.7 In extreme cases, this may result in a catastrophic in-flight failure (thermal runaway), a condition that requires that the battery be disconnected from the bus. Note that when a battery experiences an in-flight thermal runaway it will normally need to be replaced (new cells/new battery).**

2. Ground Service

- 2.1** When batteries are ground serviced, distilled water is added at the end of the charge and the amount of water delivered is recorded for each of the cells.
- 2.2** In the electrochemical process in the cells, water is absorbed by the plates during discharge and water is released during charge. It is for this reason that the only time when the electrolyte level can be tested and adjusted is at the end of the charge process (topping charge). Typically, when cells reach 1.6V or higher.
- 2.3** If water is added at other than at full charge, there is the danger that spilling of electrolyte will take place when the battery reaches full charge. When the water evaporates, there will be a conductive white residue (Potassium Carbonate) deposited over the cell top, links and posts giving a clear indication of overfilling.
- 2.4** An exception to the when-to-add-water-rule is if a high cell voltage develops during charge (usually over 2V). This is an indication that the cell is “dry”. At this time, an injection of 10cc to 20cc will bring the cell voltages to normal levels.
- 2.5** It is also advised to initially dispense 5cc to 10cc on each cell for a battery that has a known history of high water consumption or if the battery has remained on the shelf for a prolonged period of time.
- 2.6** Uneven water consumption can be an indication of cell imbalance, cell age and cell damage.
- 2.7** Battery overheating during bench charging can be the result of low initial electrolyte levels.
- 2.8** The CMM for each battery/cell provides the basic information of consumable water level as a guide to determine when the electrolyte loss becomes excessive.

3. Summary

- 3.1** It is for all of these reasons that measurement and recording of water levels during bench charging must be performed to obtain a more complete picture of the condition of the battery.