ROLLS BATTERY ENGINEERING

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The positive power choice

Bulletin 614, PM, Charging and Discharging Batteries;

Renewable Energy Applications

Introduction

Charging recommendations for flooded lead acid batteries have been based on past practices and often presented as general statements. In actuality, charging practices should be based on system applications and availability of charging sources. Rolls / Surrette Batteries are designed with thick plates, high density active material; for cycling service and to minimize the impact of heavy charging. These two design parameters, coupled with other design features, require more lead per unit which increases battery life in high cycle applications. The disadvantage of this design is marginally lower charge acceptance. This bulletin addresses this and clearly states that Rolls/ Surrette batteries should be charged at higher voltage settings depending on RE System design and are designed for cycling use.

Charging Parameters

Bulk/ absorption set points have been derived from the automotive industry and are for two reasons only. 1) The batteries do not get excessively hot and 2) the batteries do not use excessive amounts of water. These charging regimes also assume that excess power is available from a constantly running internal combustion engine. Because of these reasons the charging voltages can be increased as long as temperature does not get excessive and batteries do not consume large amounts of water causing undue amounts of maintenance.

Automotive batteries are 12V and in general the batteries cells are in a 2 x 3 layout and reside in a high temperature environment. Rolls/ Surrette batteries generally have cell layouts of simply single cells, 1 x 2 or 1 x 3 layouts. Heat transfer (away from the plates into the acid and out of the battery case) is much better than in standard layouts or with steel trays. This means more aggressive charge regimes (higher bulk absorption settings) can be used.

Consideration of application of use is important and will affect how the charge regime that should be used. In most alternative energy applications, maximum charge application is only available for 6-8 hrs. Meaning, the majority of charging has to be completed during this time frame to avoid reliance on an auxiliary generator further reduction in the battery's state of charge (SOC). Consideration has to be given also to whether the system is grid tied for back up power or stand alone.

Off Grid Systems

Off grid systems generally consist of solar PV panels and a battery bank. With these components the following voltage settings are recommended:

Charge Stage	Volts per Cell (VPC)	12V	24V	48V
	Min – Mean – Max	Min – Mean – Max	Min – Mean – Max	Min – Mean – Max
Absorption / Bulk	2.40 – 2.45 - 2.50	14.4 – 14.7 – 15.0	28.8 – 29.4 - 30	57.6 – 58.8 - 60
Equalization	2.58 - 2.63 - 2.67	15.0 – 15.8 - 16.0	30.8 – 31.6 – 32.0	61.6 – 63.2 –64.0
Float	2.20-2.22 -2.23	13.2 – 13.3 - 13.4	26.4 – 26.6 – 26.8	52.8 – 53.2 - 53.5

When a voltage setting is chosen the length of time the bank is being held at constant voltage is to be considered. If only a short absorption time is possible then the voltages settings should be at the higher levels. If a long absorption time is possible then the voltages should be lowered.

For example with a large PV array, small battery bank and minimal loads the lower settings should be chosen if it is apparent the battery bank can be held at the bulk/ absorption voltage for a minimum of fours hours. When the battery bank is put through the first 10 normal cycles the specific gravity (SG) of a pilot cell should check and recorded and if the bank is receiving full charge each cycle the SG should be slightly increasing as the battery gasses and loses water due to overcharge. Please refer to bulletin 609, Voltages, Specific Gravity and State of Charge for further info on determining cycle depth and full charge.

If the battery bank is large in relation to the PV array (C/20 min) and loads are large then the batteries will require a higher voltage setting. Also the battery should be cycled deeply (i.e. to 50%) before starting an auxiliary charge source such as a generator. Once every three months the bank should be discharged to the low voltage set point before starting the generator. This is usually dependent on the cut-off of the inverter which is usually 11 volts on a 12V system. The batteries are designed to be cycled and a deeper discharge forces electrolyte deeper into the active plate material and helps open up fresh reaction sites. With large battery to PV systems, it is imperative that the battery bank is returned to 100% SOC once every 30 days. Full charge can be determined by charge acceptance, which is ~2% of capacity at 100% SOC.

Opportunity Equalization

Systems with smaller PV arrays in respect to the battery bank should be also equalized more often. Bulletin 605 describes the differences between "preventive" and "Corrective" equalization. "Corrective" equalization should be avoided as it is bothersome, time consuming and can increase generator run time. It is recommended to "opportunity equalize" the batteries when it is known sun will be available at a convenient time. The auxiliary charging source (generator) should be started in the morning, with minimal loads running and bank brought to the bulk/ absorption voltage. The bank should then be put on an equalization charge and brought up to a specific gravity of 1.265. This should be continued until the SG is at 1.265 or the electrolyte temperature reached 115ºF in temperate climes. (125ºF in hot ambient conditions).

Grid tied systems-Back up battery banks

Normally these systems see very little cycle service and, at most, are cycled once a month. If cycled, the banks should be charge for 3 hrs at the mean voltage setting. After charging, the water level should be checked and a specific gravity reading taken. If the specific gravities are not 1.265 the bank should be further charged.

Commissioning a Battery Bank

When a bank is first put into service the electrolyte levels and specific gravities should be check and recorded. As a battery is charged, water is electrolyzed into hydrogen and oxygen gas. Original electrolyte levels should be noted and replacement water should be added back to this level.

The battery bank should be placed on a bulk / absorption charge and voltage settings should be set at the maximum level of the above table. This voltage should be held for 6 hours and final current, if monitored, should be 2% of the 20 hour capacity rating. If not the bulk / absorption charge should be continued.

Technical Assistance

Surrette Battery has built our business on providing direct and timely customer support / assistance. Please call our technical Assistance line if there are any questions or concerns;

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