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SPECIFIC GRAVITIES OF M-SOLAR CELLS

Top of charge specific gravities of M-Solar cells when new will be 1.260/1.270. During use this will gradually increase to the specified working level of 1.280/1.290. However, the term top of charge means that the cells have been charged at a constant current of 3.5% to 7%C_{10}A until the voltages and specific gravities have remained constant over 3 x 1 hourly readings (alternatively at a voltage of 2.60v.p.c. or higher until the specific gravities have remained constant).

It has come to our attention that in many cases of M-Solar use the battery charges to 2.40/2.45v.p.c. and then immediately reverts to float voltage instead of going to absorption for a period. As a result, even though the battery may be substantially charged (probably in excess of 80% SOC) the specific gravities are in the order of 1.210/1.220.

Even when the system allows for absorption charge for 3 to 4 hours, specific gravity may well not rise to the specified top of charge level (perhaps only to 1.230/1.250), despite the fact that the battery is in fact charged and all the active materials have been converted back to spongy lead and lead dioxide.

The reason for this is that the acid released from the plates during charge is denser than the surrounding electrolyte and therefore falls to the bottom of the cell. In order for the acid to mix with the electrolyte the battery must be brought to gassing voltage for a period after reaching full charge. Whilst voltages of 2.40/2.45v.p.c. are slightly above the gassing stage the gassing is not vigorous and may not allow complete mixing in the time available. If this is repeated for long periods there may be stratification of the electrolyte resulting in strong acid at the bottom of the cell which can cause permanently damage.

It is therefore necessary to provide an equalising charge on a regular basis in order to ensure complete mixing of the electrolyte.

Recommended set points for M-solar applications are shown below.

SOLAR SYSTEM SET POINTS

Whilst there can never be hard and fast set points for a solar system due to variations in operating modes the following data is given as a guide.

Normal recharge maximum voltage:	2.45 Volts per cell
Absorption time:	3 to 4 hours
Float voltage:	2.27 Volts per cell
Equalisation voltage:	2.60 Volts per cell
Equalisation interval:	20 days
Duration of equalise charge:	2 hours
Low voltage cut-off (100% DOD)	1.85 Volts per cell*
Temperature compensation coefficient:	2mV per cell per ^{O}C

* Based on the assumption that the system has been designed to give 3/5 days autonomy and that recharge will be commenced within 48 hours of reaching fully discharged condition.

The PV array should be sufficient to supply the daytime load while maintaining the battery in a charged state on days of average irradiation.

In addition we recommend that batteries be fully equalised when individual cells become out of step. This condition is present when:

(1) The end of charge voltages of individual cells differ by more than 0.10 Volt from the lowest to the highest voltage.
(2) The specific gravities at completion of charge vary by more than 0.030 or do not rise to within 0.030 of the normal recommended top of charge value.

Full equalising requires charging at approximately 3.5% of the 100 hour capacity. At this rate of charge, voltages of 2.60 to 2.75 volts per cell should be achieved (when new at temperatures of 20/25^{O}C; the voltage will be lower at higher temperatures and as the battery ages). If the solar panels do not have the power necessary for equalising, other means, such as a generator should be provided. Equalisation is regarded as complete when there is no rise in voltages or specific gravities over three one hourly readings.

Loads not able to withstand the higher voltage should be isolated from the system whilst equalising is in progress.

Source: C J Hardman
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