FLOODED LEAD ACID BATTERY MANAGEMENT WALLCHART

STANDARD RESTING CHARGES, 2vpc cells, SLI and Deep Cycle @ 25ºC (.01-.05v vpc difference fully charged is OK, all vpcs drift over time, and cells will trickle discharge also, when not in use, hence float (volts), & trickle (amps), charging.)

SOC%	12 VOLT	24 VOLT	VPC		
100	12.70	25.40	2.12/5		max 2.583vpc @ 15.5v and 31v resp.
90	12.50	25.00	2.08		
80	12.42	24.84	2.07	20%	SLI battery cycle maximum
70	12.32	24.64	2.05		
60	12.20	24.40	2.03	40%	solar battery optimum DOD
50	12.06	24.12	2.01	50%	
40	11.90	23.80	1.98		
30	11.75	23.50	1.96		
20	11.58	23.16	1.93	80%	
10	11.31	22.62	1.89		
0	10.51	21.02	1.75	Full DOD	

RULES of THUMB:
SG+0845 = vpc, resting charge
Ohms pc = 7.5, full r. charge
(both @ 25ºC, normal acid range)

24 volt deep cycle cells: **Do not discharge below 20-40% resting charge if possible.** Battery (bank) will charge to 25.4v+ by PV or generator, (each day if possible), but for optimum battery health, a proper charging regime should follow, min. 2 hours per month. Equalize when there is a min of .2v difference between cells, regardless, smaller batteries will require less electrolyte de-stratification. **Routine charging should extend into absorption** @ 25ºC and above, up to 28.6v; and beyond absorption, up to 29.6v, when below 12.7˚C. (NB, for 12v halve 24v values) **AGM and Gel VRLA battery maximum charge input is only >2.35 vpc, use dedicated VRLA regulators!**

Boost @ 20 amps to 30v, briefly, full charge @30v is 2.583 vpc, **incl.**
Absorption 27.2v to 28.4v, charge rate may slow slightly. Then for
Equalisation, take to 31v, taper amps to maintain venting 30-31v, 30 to 180 mins.
Float Drop amps, taper to 25.6v-26.4v, maintain 2.15-23 vpc.
Rest Being fully charged, 25.4v, @ 2.12-15vpc, EMF/OCV.

IN DETAIL: Advance charge, up to 20 amps, and raise only when needed to initiate **equalization** at 31 volts, and for **de-sulphation**, when amps are then tapered, to enable a vpc of 2.4/5v. Both may be concurrent. **Bubbling and venting at 30v-31v will be sufficient for equalization.** Bubbling begins at 2.2vpc, so beware of overcharging beyond 31v, damaging and unnecessary, causing heat and plate breakage.

TRUEST VOLTAGE READINGS ARE TAKEN DIRECTLY FROM THE BATTERIES, WITH A RELIABLE HANDHELD DIGITAL VOLTMETER

HYDROMETER:

	SLI	DC
good	1275 to 1300	1220 to 1240
sat	" 1225 to 1250	" 1200 to 1220
poor	" 1150 to 1200	" 1100 to 1150

Test for SG peak during equalization then discontinue charging. Add or subtract .004 for each 5ºC above or below 25ºC for SG correction.

Voltage and hydrometer readings should always be concurrently optimum. Battery capacity is progressively limited with cold, factor this into winter usage calculations. Freezing point means 35% capacity reduction, plus the added limitations caused by age and condition. Heat and/or poor plate condition cause resistance, and cold limits capacity. Battery temperature and state will influence charging, by PV or generator. Battery life is halved by every 9ºC over 25ºC, if unregulated. **Temperature regulation for battery banks is strongly recommended.**

Capacity to receive charge v temp: **Fully charged & good SG; @ 27ºC, 100%; @ 0ºC, 65%; @-18ºC, 40%. Battery temperature, 25ºC for optimum performance, 25ºC maximum for PV panels.**

The quicker and higher the charge return and hold, the healthier the battery. Allow adequate time for plate reformation, the key to optimum battery charging and long-term health. A brewstrip thermometer on the battery, plus calibrating wall thermometer, account for temperature lag. Ensure adequate ventilation of batteries at all times. Rotate end battery positions minimum once per annum, ad hoc, to maintain uniform condition.

Regular top-ups and/or trickle charging are needed when batteries are not in use, see FLOAT above, and the normal charge routine still applies. Always use 4-stage regulators to taper any charge, especially during unattended operations. When fully charged, anodes (PbO2) should be noticeably chocolate, and cathodes (Pb) grey, in colour.

Slow and steady C10 charge and C20 discharge best, 20-40% discharge optimum for longer battery life, with no large quick drains or shallow cycles under 5%. Use a generator at high demand periods, and for PV charge cycle lag and/or equalization.

Make a chart to track individual battery health, record readings regularly. Always check connections and wiring first when faultfinding, before more complex steps.

Customise these Wallchart figures according to ambient temperatures, plate chemistry, manufacturers specifications, and/or individual PV systems etc., when necessary.

See also A Manual of Home Solar Power Management, and Why, http://nofrillstech.net/ 11.1.08