Deka®

SOLAR

PHOTOVOLTAIC BATTERIES

Renewable Energy Charging Parameters

Renewable Energy applications that depend on battery power as part of the system operation must be at maximum performance at all times. To ensure this high rate of performance, the charging system must be set properly. A battery that is undercharged or overcharged will affect the performance of the entire system. The below list of requirements for setting inverter / charge controllers to properly charge East Penn lead-acid batteries should be followed. It is important to compare these requirements with the setting(s) on your inverter / charge controller.

	Monobloc			2-Volt Cells		
	GEL	AGM	FLOODED	GEL	AGM	FLOODED
Bulk Charge Stage Max. Current	30% of $C_{20}^{1.75\ vpc}$ or 6 times $I_{20}^{1.75\ vpc}$	30% of $C_{20}^{1.75\ vpc}$ or 6 times $I_{20}^{1.75\ vpc}$	30% of $C_{20}^{1.75\ vpc}$ or 6 times $I_{20}^{1.75\ vpc}$	15% of $C_{20}^{1.75\ vpc}$ or 3 times $I_{20}^{1.75\ vpc}$	15% of $C_{20}^{1.75\ vpc}$ or 3 times $I_{20}^{1.75\ vpc}$	20% of $C_{20}^{1.75\ vpc}$ or 4 times $I_{20}^{1.75\ vpc}$
End Condition	**Max Time (Hr) = Ahr x 1.2 / Avg. Current (A) - Voltage limit equal to ""Absorption (Regulation) Stage"" limits"**					
Absorption (Regulation) Stage Constant Voltage	2.35 - 2.40 vpc	2.35 - 2.40 vpc	2.40 - 2.45 vpc	2.37 - 2.42 vpc	2.35 - 2.40 vpc	2.40 - 2.45 vpc
End Condition	**Charge until change in current < 0.10A per Hr / Max Time: 12Hr**					
Float Charge Constant Voltage	2.24 - 2.26 vpc	2.24 - 2.26 vpc	2.30 - 2.35 vpc	2.25 - 2.30 vpc	2.24 - 2.26 vpc	2.30 - 2.35 vpc
End Condition	**No Time Limit**					
Equalize Charge Constant Voltage	2.40 - 2.43 vpc	2.40 - 2.43 vpc	2.50 - 2.55 vpc	2.43 - 2.48 vpc	2.40 - 2.43 vpc	2.50 - 2.55 vpc
End Condition	**Charge until change in current < 0.10A per Hr / Max Time: 12Hr**					
Temperature Temperature Coefficient	-3 mV / cell / °C[1]	-3 mV / cell / °C[1]	-3 mV / cell / °C[1]	-3 mV / cell / °C[1]	-3 mV / cell / °C[1]	-3 mV / cell / °C[1]

[1]Minimum charge voltage limited to 35°C (95°F), Maximum charge voltage at 15°C (59°F)

Voltage Limits shown based on 25°C (77°F)

Cut-off parameters per charge & equalize intervals are application specific & will vary dependent upon site specific characteristics such as: temperature, days of autonomy, array to load ratio, etc…

BULK CHARGE STAGE TIME CALCULATION

Max Time (Hr) = (Ahr x 1.2) / Avg. Current (A)

Ahr = Amp hours removed during discharge.

1.2 = Recharge multiplier

Avg. Current = Average current available to battery from charger.

Note: *Avg. Current should be ≤ limits expressed in preceeding chart*

Max Time (Hr) – Maximum charge time for battery to reach 80% - 90% state of charge

EXAMPLE OF TYPICAL 3 STAGE CHARGER

Bulk Charge Stage – Current is applied to the batteries at the maximum safe rate they will accept until voltage rises to near (80-90%) full charge level. The battery voltage rises because the charging current that is provided by the battery charger is replenishing its internal charge capacity. The charger current is flat (constant) and the battery voltage is rising.

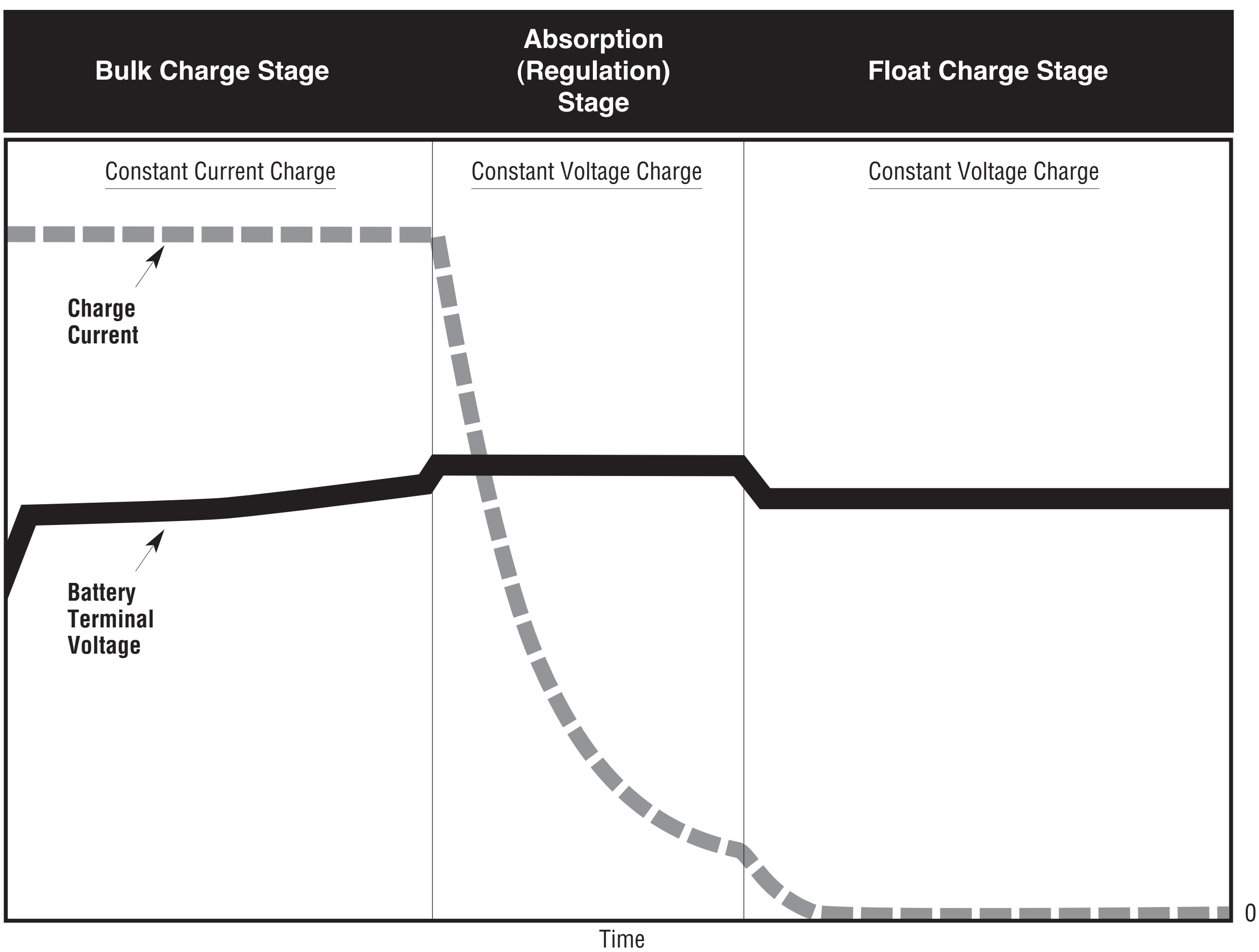
EXAMPLE OF TYPICAL 3 STAGE CHARGER *(con't)*

Absorption (Regulation) Stage – The charger will attempt to hold its output voltage constant while the battery continues to absorb charge (draw charging current) from the charger. The rate at which the battery continues to absorb charge in this mode gradually slows down. The amplitude of the charger current is gradually decreasing. The charge current is falling and the battery voltage is flat (constant).

Float Charge – The optimum voltage level at which a battery string gives maximum life and full capacity.

Equalize Charge – A charge, at a level higher than the normal float voltage, applied for a limited period of time, to correct inequalities of voltage, specific gravity, or state of charge that may have developed between the cells during service.

Note: Equalize charging not required on VRLA (AGM / Gel) as part of a daily charge setup. Based on PV applications, unpredictable recharge availability, periodic equalize may be required. Consult EPM (East Penn Mfg) for recommendations.



GLOSSARY

AGM – Absorbed Glass Mat – A class of VRLA (Valve Regulated Lead-Acid) battery in which the electrolyte is absorbed into a glass mat.

Ambient Temperature – The average temperature of the battery room. Temperatures below 77°F (25°C) will reduce battery capacity. Temperatures above 77°F (25°C) will reduce battery service life.

Amp Hour (Ah) – Amps times Hours

C20 – Battery capacity measured in Ah (amp hour) at the 20hr rate.

End Voltage – The minimum voltage at which a DC system will operate.

Flooded – A battery in which the products of electrolysis and evaporation are allowed to escape to the atmosphere as they are generated. Electolyte is free flowing throughout the battery.

Gel – A class of VRLA (Valve Regulated Lead-Acid) battery in which the electrolyte is immobilized in gel form (sulfuric acid mixed with silica).

Overcharge – The number of ampere-hours (Ah) charged divided by the number of Ah discharged times 100. Typical overcharge values are between 105% and 130%.

Temperature Correction – A factor used to compensate for battery capacity and/or adjust battery voltage at ambient temperatures greater than or less than 77°F (25°C).

Undercharge (Deficit charge) – Charging a battery with less ampere-hours (Ah) than is required to return the battery to its initial state-of-charge. This results in a reduction in the battery state-of-charge.

VPC – Volts per Cell

VRLA – Valve Regulated Lead Acid – a lead-acid cell / battery that is sealed with exception of a valve that opens to the atmosphere when the internal gas pressure exceeds atmospheric pressure by a pre-selected amount. VRLA batteries provide a means for recombination of internally generated oxygen and the suppression of hydrogen gas evolution to limit water consumption.

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