Battery Charging

- Proper charging
  - Set charge voltage to type of battery
    - WET, AGM, GEL
- Bulk charge is based on current and voltage
    - Current is 30% of C20 of battery bank
    - Voltage is the absorption voltage of the battery type
    - 85-90% capacity with bulk charge
- Absorption voltage – use manufactures recommended voltage
  - Absorption charge based on time
  - Needs to charge to 115-120% of what you discharged
- Undercharge – Sulfate
- Overcharge – Gas off electrolyte

EPM – Charging parameters

BULK CHARGE STAGE	GEL	AGM	FLOODED
MAX CURRENT MONOBLOC DESIGN	30% of C20	30% of C20	30% of C20
MAX CURRENT SINGLE CELL DESIGN	20% of C6	20% of C6	20% of C6
ABSORPTION (REGULATION) STAGE			
CONSTANT VOLTAGE	2.35 – 2.40 vpc	2.30 – 2.35 vpc	2.40 – 2.45 vpc
FLOAT CHARGE			
CONSTANT VOLTAGE	2.25 – 2.30 vpc	2.25 – 2.30 vpc	2.30 – 2.35 vpc
EQUALIZE CHARGE			
CONSTANT CHARGE	2.40 – 2.45 vpc	2.35 – 2.40 vpc	2.50 – 2.55 vpc
VOLTAGE LIMITS AT 25C (77F)			

Charging parameters - ex

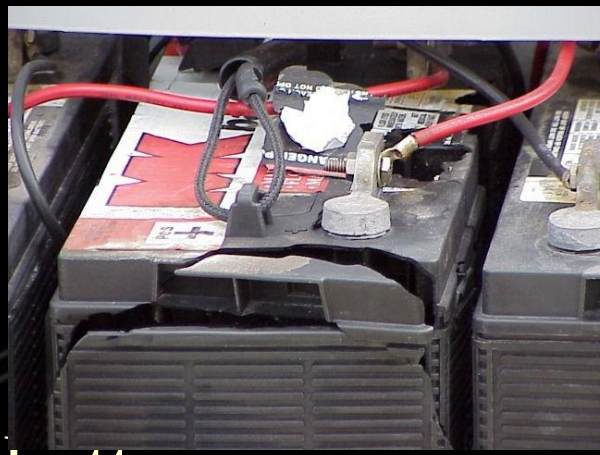
- Example of setting up correct charger
- Battery bank – 16 – 8G30H GEL
  - 4 strings of 4
  - 8G30H – 98 AH @ C20
- Bulk charge set at 30% of C20
  - 98 x 30% = 29.4 amps @ C20
  - 29.4 amps x 4 strings = 117.6 amps (max)
  - 117.6 max amperage to charge this battery bank
- Absorption voltage is 2.35 – 2.40 vpc (range)
  - 2.40 vpc x 6 cells = 14.40 x 4 batteries = 57.60 dc volts
  - Absorption time is set to a minimum of 3 hours
- Float Voltage is 2.25 – 2.30 vpc (range)
  - 2.30 vpc x 6 cells = 13.80 x 4 batteries = 55.20 dc volts

Absorption time recommendations

Battery AmpHrs Capacity	Suggested Absorb Time	Battery AmpHrs Capacity	Suggested Absorb Time
200 to 300	60 minutes	1310 to 1500	240 minutes
310 to 500	90 minutes	1510 to 1700	270 minutes
510 to 700	120 minutes	1710 to 1900	300 minutes
710 to 900	150 minutes	1910 to 2100	330 minutes
910 to 1100	180 minutes	2110 to 2300	360 minutes
1110 to 1300	210 minutes	2310 to 2500	390 minutes

Battery Charging

- Improper Battery Charging
  - Overcharging
  - Undercharging – (Solar)
  - Over Discharging
- Most Batteries do not fail due to a battery problem!



Battery Charging… cont.

- Your batteries are a good indicator that you have either a good or a bad maintenance program
  - Failing batteries should raise a red flag:
    - Charger not working properly
    - Temperature probe not working/connected
    - Battery breaker off
    - Faulty products
    - Improperly designed system

Why Overcharging is Bad:

- Water (H_2O) split into H & O
  - Driven out of cell
  - Reduces electrolyte level or dries out SVR cell
  - Potentially explosive
- Internal Heat Increases:
  - Accelerates POS grid corrosion
  - Warps plates
  - Oxidizes (rusts) and weakens POS grid and separator

If Overcharging is so bad... Why not Undercharge?

- Sulfate on both plates hardens:
  - to a point where it can not be driven back into electrolyte
- POS grid oxidizes in water:
  - Accelerates POS grid corrosion
  - Oxidizes (rusts) and weakens POS grid
- Hydration
  - 1.050 SpG = solubility of Pb in Sep.. pores
  - recharging = re-crystallization of Pb = Shorts

Over-Discharging

- Battery starts to break down and is in a vulnerable state when it is over-discharged
- Sealed Battery has visible characteristics
  - Battery creates a vacuum
  - Top and sides will often have ripples in them
- Starts when battery is discharged below 10.5 volts
- How can this happen?
  - Low voltage cut off not working
  - Parasitic loads
  - Overcharge/Undercharge

Over Discharging

- Parasitic Loads
  - Any DC externally wired load
  - Any DC load powered after LVD shuts off