Operation From Emergency Power

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When and Why?

- During disasters, commercial power may not be available
- Communications may be necessary in any emergency

What Happens?

What Happens?

- Need to have alternative sources of power:
  - Battery
  - Generator (fossil fuel, wind, hydro, hydrogen fuel cell)
  - Solar
- The available alternative power source is exhausted

How to prepare?

- Size battery supply to maintain station operation for desired period
- Keep battery source charged for operation all the times
- Have a way to recharge battery source

Definitions

- Primary Cell – An electrochemical energy device which is discharged once and is then discarded
- Secondary Cell – A reversible (charge and discharge) reusable electrochemical energy device
- Amp Hour (AH) – Current in amperes multiplied by time in hours

Definitions

- Capacity (C) – Ampere hours, specified by the manufacturer, available from a cell or battery
- Constant Current Charge – A method of cell charging by applying a non-varying current to a cell or battery
- Constant Voltage Charge – A method of cell charging by applying a non-varying voltage to a cell or battery

Definitions

- Float Charge – Application of a constant voltage to maintain full cell or battery capacity
- Overcharge – Excess charge put into a cell or battery beyond that needed for full charge
- Cell Reversal – Cell polarity reversal caused by excessive discharge

Definitions

- Cell End-of-Life – 80 percent of cell rated capacity
- Cycle – A charge plus a discharge

Sizing Battery Capacity

- Basic questions to answer –
  - What is your expected demand?
  - How long will you need to operate?
  - Does your battery supply need to be portable?
  - What means to you have to recharge batteries when no commercial power is available?

Determining Load

- Damage to both the equipment and battery can result when attempting to operate them at lower voltages than they are designed to use
- Check your equipment manuals for voltage and current requirements
- You can measure the actual current drawing using an ammeter in the circuit supplying power to the equipment

Determining Load

$$A_a = R_a + (T_a - R_a) \times T_t$$

Where:

A_a is average current

R_a is current on receive

T_a is current on transmit

T_t is percent of time in transmit

Determining Load

$$A_a = R_a + (T_a - R_a) \times T_t$$

$$A_a = 1 + (10 - 1) \times 25\%$$

$$A_a = 3.25 \text{ amps average}$$

Determining Battery Size

$$C = A_a \times T_o$$

Where:

C is capacity in amp-hours

A_a is average current in amperes

T_o is desired operating time in hours

Determining Battery Size

$C = A_a \times T_o$

$C = 3.25 \times 12$

$C = 39$ Amp-hours

Gel Cell Batteries

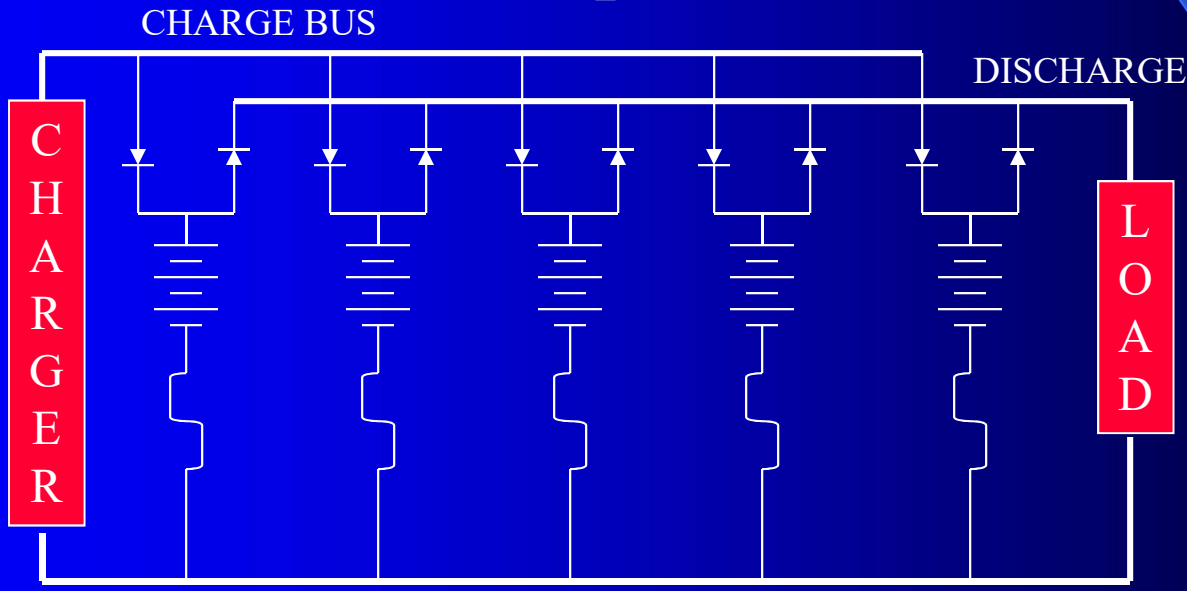
- Optimum operation is designed for room temperature (72 degrees F)
- Constant-voltage charging is the most efficient and fastest method of Gel Cell charging
- The most desirable battery life and recharge characteristics are enhanced by use of a two-step, constant-current charger followed by a lower trickle charge rate

Gel Cell Batteries

- Gel Cell fast charge is a method which returns dischargeable energy to full capacity in less than four hours
- Typically have open circuit voltage of about 13 V when fully charged and 11 V when fully discharged
- Most amp-hour ratings are based upon a discharge rate of 1/20 of capacity for a specified rate of discharge

Gel Cell Batteries

- When more than four cells are operated in parallel, steering diodes and individual fuse protection should be provided:



Gel Cell Batteries

- Rule of thumb: 1 AH per watt PEP – adequate for 24 hours of SSB or 12 hours of FM, CW or digital at a typical duty cycle
- Gel Cells should be maintained at 2.35 V ± 0.05 V per cell float/trickle charge for standby power applications

Gel Cell Batteries

- Twelve-volt Gel Cell batteries may be connected in a “float”-charge-like manner, directly to a regulated 13.8 VDC power source
- If using marine/automotive charger, make sure current limiting is used to preclude exceeding 14 V during peak charging
- Discharging a cell completely, to zero volts, can cause cell polarity reversal

Used Gel Cell Batteries

- Should be inspected, recharged if necessary and tested
- Any 12 V batteries having an open circuit voltage of 12.8 V or greater are ready for testing
- Charge those less than 12.8 V using 13.8 V power supply
- If not accepting charge after 4 hours, discard

Used Gel Cell Batteries

- Load test batteries
  - Load in amperes that approximates capacity in amp-hours for 10 seconds – voltage stabilizes after a few seconds, does not continue to fall and recovers within a few seconds after load removed
  - Use approximate operating load for a minute of full-power key-down

AGM Batteries

- Sealed lead-acid battery, initially used in military aircraft
- Capable to deliver high currents on demand and offers a relatively long service life
- Stands up well to low temperatures and has a low self-discharge
- Charge that is up to five times faster than the flooded version

AGM Batteries (cont'd)

- Better cycle life than with flooded systems
- Sensitive to overcharging (gel has tighter tolerances than AGM)
- Must be stored in charged condition (less critical than flooded)

Battery Care & Safety

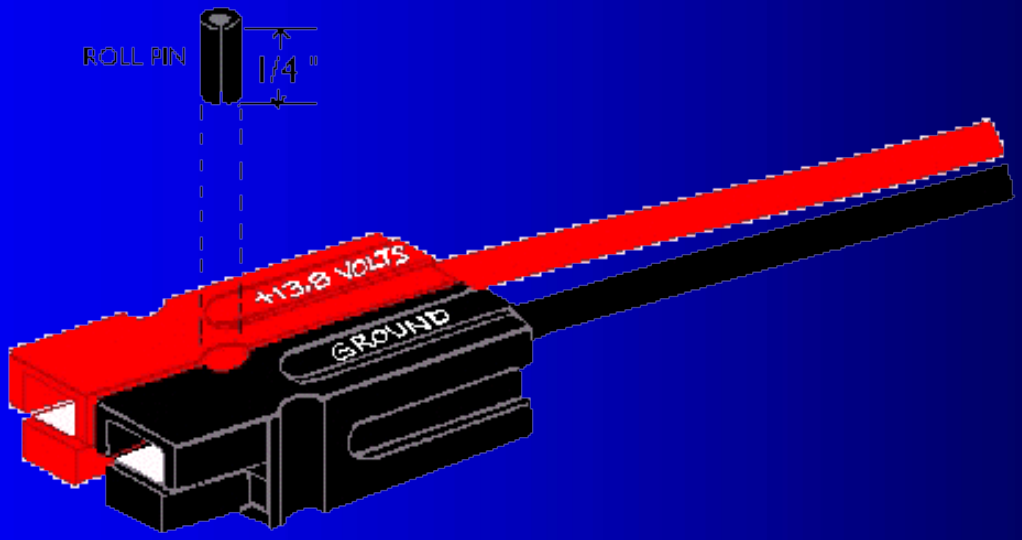
- Charge the battery as soon after use as possible
- NEVER short out the terminals of a battery
- If using wet lead-acid cells, review and follow safety procedures for working with those cells - you're dealing with an acid solution

Battery Storage

- Store batteries in a garage or other protected area when not in use
- When storing batteries in your vehicle, protect them from heat
  - Store in an insulated container
  - Add a cool/heat (blue ice) pack to add mass

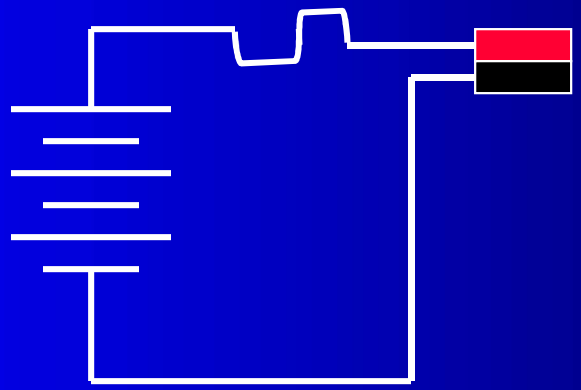
Power Connectors

- ARES, and the amateur radio community in general, has adopted the Anderson PowerPole connector:

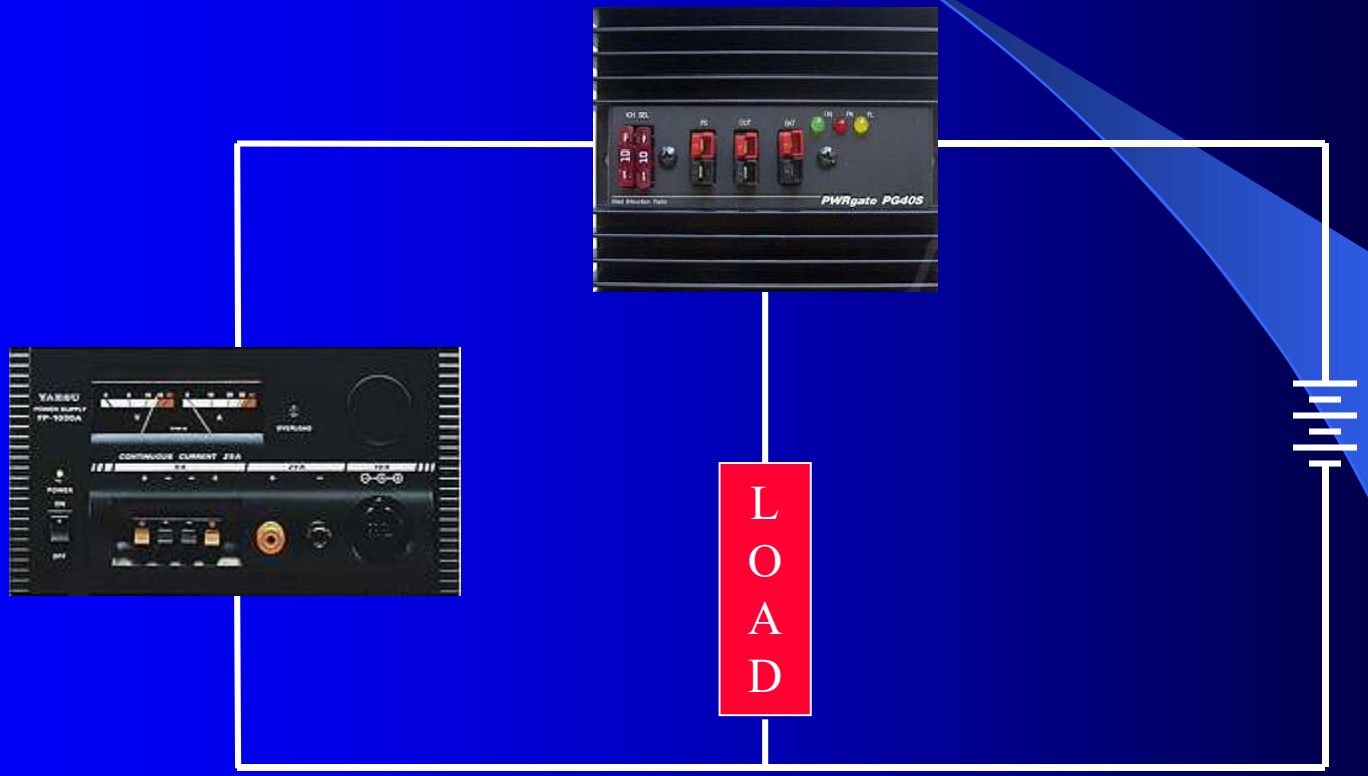


Power Connectors

FUSE



Backup Circuit



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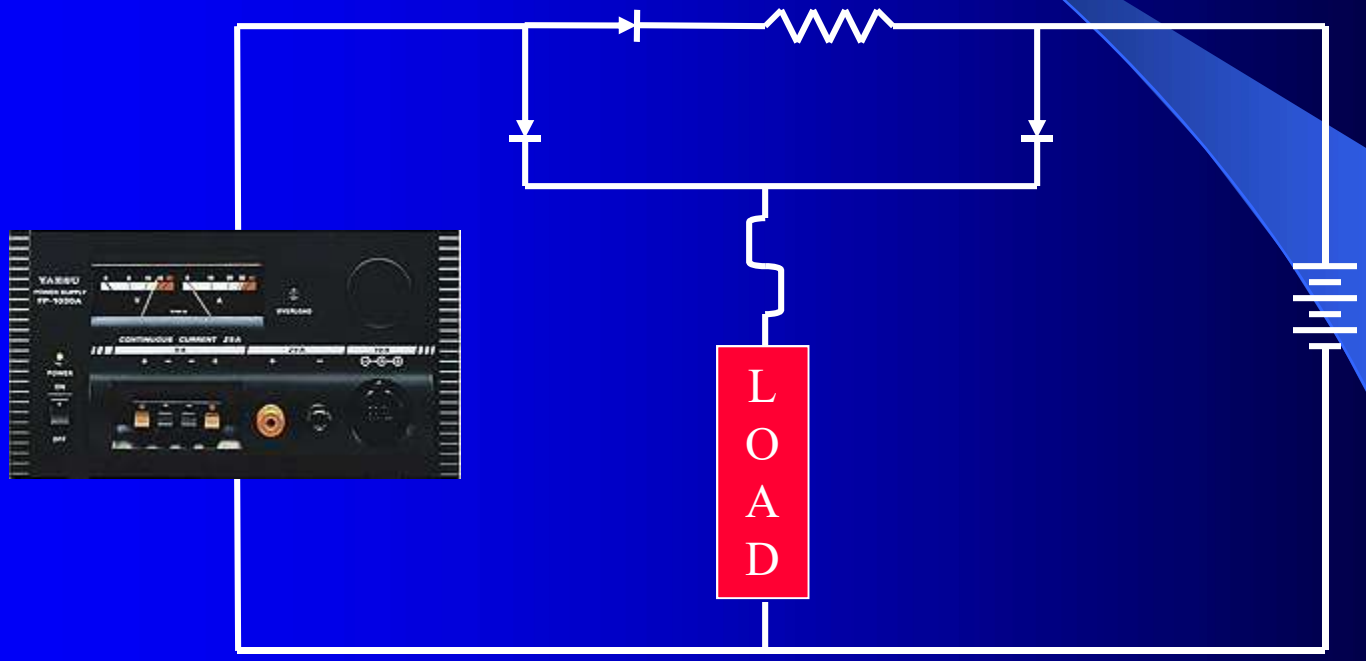
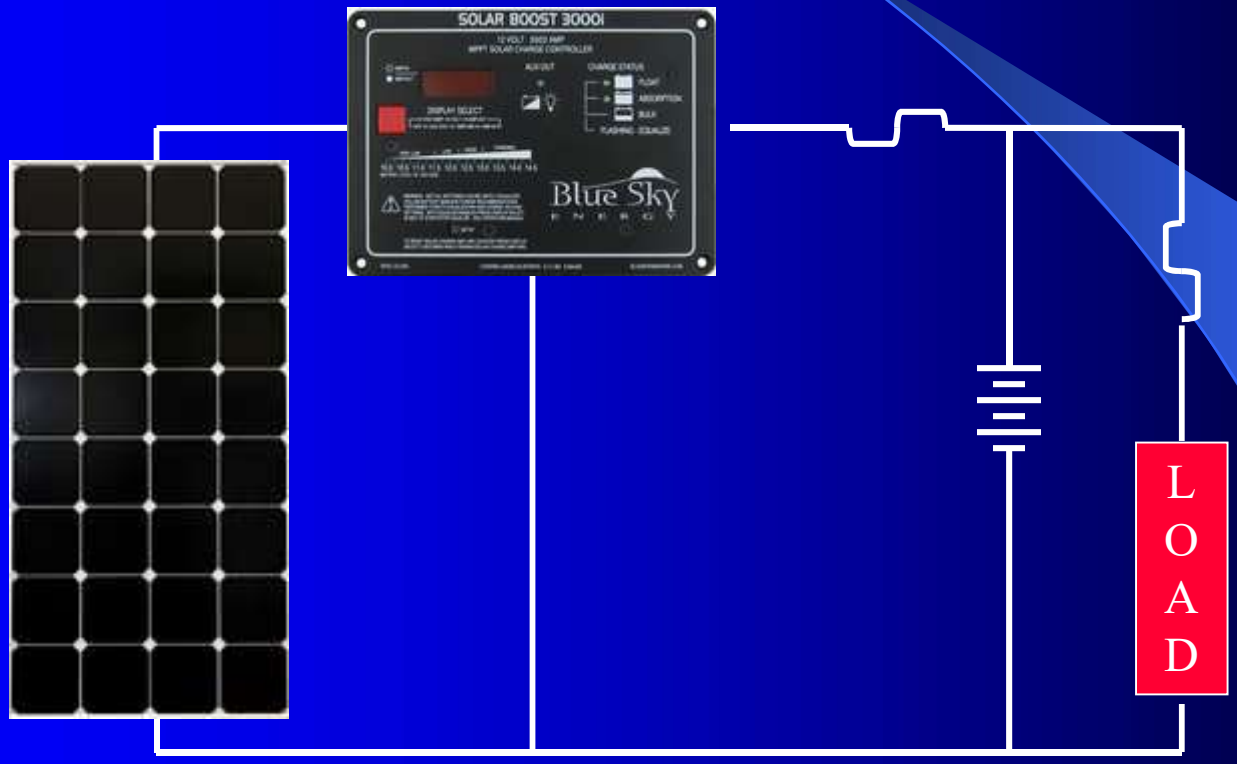


Solar Configuration



12V Generator/Alternator

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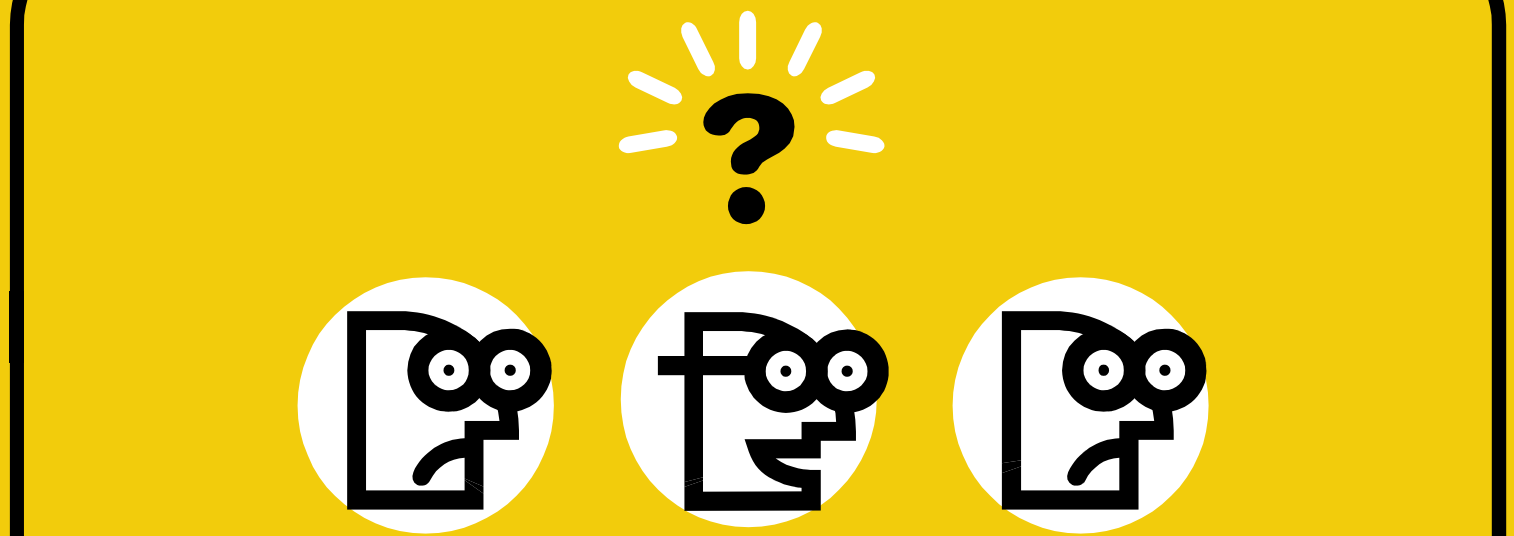

It's QUESTION TIME!!