Maximize Life and Performance of Batteries

Courtesy East Penn Mfg. Co., Inc.

In order to size, test, charge, install, maintain, and store batteries it's important to follow consistent instructions. The following information pertains to gelled electrolyte and absorbed glass mat (AGM) valve-regulated lead-acid (VRLA) batteries.

Be sure that the battery or set of batteries is properly sized, with plenty of power for your application. As with any piece of equipment the harder any battery has to work, the sooner it will fail. For example:

Figure 1
Typical VRLA Battery Cycling Ability vs. Depth of Discharge

Average Capacity Withdrawn	Typical Life GEL	Cycles to Failure AGM
100%	450	150
50%	1,000	370
25%	2,100	925
10%	5,700	3,100

As you can see, the shallower the average discharge, the longer the life. Make sure your batteries have plenty of power for longest life. Contact your dealer if you have any questions.

Always wear safety glasses during proper testing. Use a voltmeter to test for state of charge. The reading will tell you how much charge is left in the battery. Different type batteries have different readings: (Figure 2).

Use a load tester (available at dealer or most service stations) to determine the strength or reliability of a battery that's been in service and may be suspect.

- Recharge if the open circuit voltage is below 75 percent.
- Set the load at half the CCA or three times the 20-hr ampere-hour capacity. Apply the load for 15 seconds.
- If the "on load" voltage stabilizes at or above 9.6 volts at 70 degrees F (21 degrees C) and above, the battery is good. If it falls below 9.6 volts, recharge the battery and retest. If it falls below 9.6 volts a second time, replace the battery.

Figure 2 **Open Circuit Voltage vs. State of Charge***

State of Charge	Open Circuit Voltage: Flooded Wet Cell	Sealed Gel Electrolyte	Sealed Absorbed Electrolyte
100%	12.60 or higher	12.85 or higher	12.80 or higherd
75	12.40	12.65	12.60
50	12.20	12.35	12.30
25	12.00	12.00	12.00
0	11.80	11.80	11.80

Note: Divide values in half for 6-volt batteries.
**The "true" O.C.V. of a battery can only be determined after the battery has been removed from the load (charge or discharge) for 24 hours.*

Figure 3 **Charger Voltage Settings**

	Valve-Regulated Lead-Acid Batteries (at 68°F/20°C)			
	Float Service		Cycling Service	
	Optimum	Maximum	Optimum	Maximum
12-Volt Gel	13.5V	13.8V	13.8V	14.1V*
6-Volt Gel	6.75V	6.9V	6.9V	7.05V
12-Volt AGM	13.5V	13.8V	14.4V	14.6V
6-Volt AGM	6.75V	6.9V	7.2V	7.3V

Important Charging Information

A VRLA battery is pressurized and sealed, with no way to replenish the electrolyte (acid) inside. Caution! Do not open a VRLA battery. Warranty will be voided if opened.

Proper charging is critical. Overcharging will dry out the electrolyte and the battery will fail prematurely.

Be sure to use a good, fully-automatic, temperature-sensing, voltage-regulated charger, with an adjustable voltage feature. The charger must be voltage regulated. Otherwise, it will overcharge the battery and shorten its life.

Voltage regulation means the voltage will be held constant as the battery's charge acceptance rate changes. As a battery approaches full charge, its charge acceptance rate falls. The charger uses this feature and/or timing to shut down at full charge. Therefore, the battery will be fully charged without being overcharged. Battery life will be maximized.

Figure 3 shows the proper voltage settings to recharge a VRLA gel or AGM battery at 68 degrees F (20 degrees C). Both gel and AGM batteries require voltage adjustment for battery temperature. To compensate for battery temperature not at 68 degrees F (20 degrees C), **subtract** 0.005 volts per cell for each 1.8 degree F (1 degree C) **above** 68 degrees F (20 degrees C) or **add** 0.005 volts per cell for each 1.8 degrees F (1 degree C) **below** 68 degrees F (20 degrees C).

For example, if the battery temperature of a 12 volt gel battery in cycling service is 50 degrees F (10 degrees C), add .05 x six cells or .3 volts to the optimum voltage of 13.8 volts and set the charger to 14.1 volts. (Figure 3)

Never use an inexpensive constant current or "trickle" charger! Even a small current of half an ampere, if left on beyond "full charge" will overcharge any battery and ruin it.

Always keep your batteries fully charged…especially if they are to be stored for 30 days or longer. Use the state of charge chart (Figure 2) to determine full state of charge.

Constant undercharging will also adversely affect battery life and performance. Therefore, you should check to be certain that your charger or charging system (engine alternator) is fully recharging the battery or set of batteries…but not overcharging.

An undercharged battery is not at full capacity and must work harder than a fully charged battery. Therefore, its

life will be shortened. (See Figure 1.)

If your battery is maintained by an alternator run by an engine (as in boats, motor homes, autos, etc.) check the voltage regulator's output and adjust to 14.1 volts for 12-volt gel batteries (7.05 for 6-volt) or 14.6 volts for 12-volt absorbed batteries.

Storage and Maintenance

If you are storing for longer than 30 days follow these steps while wearing safety glasses:

1. Disconnect the ground cable of the battery or remove it entirely from the equipment, vehicle or vessel.
2. Store in a cool, dry area if possible.
3. Clean the battery if dirty. Discard the rag used.
4. Charge to 100 percent full charge. *Do not overcharge! Do not leave a trickle charger connected!* Discharged batteries can freeze and burst.
5. Check the open circuit voltage every 60 to 90 days. Recharge if necessary. (See Figure 2, page 10.)

Your VRLA battery is maintenance-free. All that is necessary is to keep the battery clean, fully charged, properly secured, and the terminal connections tight (but do not overtighten).

Installation Tips

Always wear safety glasses when working around batteries.

- Handle and lift batteries with care. They can be heavy.
- Clean all cable ends and connectors with a wire brush or emery cloth until shiny and free from oxidation or corrosion.
- Inspect battery tray to be sure it is clean and free from objects that could damage the bottom of the battery.
- Replace any worn cables. Replace or repaint any corroded hold-downs, shelves or trays.
- Do not install batteries in a completely sealed box or enclosure. In the event of overcharging, the gasses must be allowed to escape.
- Always connect the ground cable last to avoid dangerous sparks.
- Be careful of your connections! Be absolutely certain that the proper wire or cable is connected to the proper terminal. Expensive damage and dangerous sparks can occur if wires/cables are crossed.
- Tighten connections snugly, but do not overtighten. Overtightening can damage the battery and void the warranty. Recheck connections every 90 days.
- If multiple batteries are installed, allow at least a half-inch (13 mm) air gap between batteries to allow for cooling and normal bulging of the pressurized batteries.

With proper charging and maintenance, a high quality VRLA battery should deliver years of reliable portable power. Some of its features and benefits are:

- Totally maintenance-free operation (except for proper recharging, an occasional cleaning, and retorquing of the terminal connections).
- Will not spill if tipped.
- Very little gassing (unless overcharged).
- Safe to use around sensitive electronic equipment.
- No corrosion.
- Air transportable if properly insulated from short circuits.
- Superior rechargeability.

Do not attempt to open a VRLA battery. When opened, it loses its pressure and the plates become oxygen contaminated. The warranty will be voided if the battery is opened.

Remember to always disconnect the negative (ground) cable first when replacing batteries to prevent sparks. Connect the negative cable last when installing batteries.

A properly sized, maintained, installed and charged battery will deliver years of reliable service.

California Proposition 65 Warning: Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling.

Information provided courtesy East Penn Manufacturing Co., Inc., Lyon Station, Pa., manufacturer of Deka Batteries.

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