



SOLAR BATTERY HPF SERIES

Basic recommended safety instructions

If proper safety and maintenance techniques are performed, the HPF Series can be an extremely reliable and safe source of power. An improperly used battery can be extremely harmful and dangerous. Please review this safety and operating guide carefully before commissioning a battery bank.

1. **Avoid any short circuit or sparks**

Do not lay tools, cables, wires, or any other conducting tools or materials on or across the battery. Power Battery Co. recommends that insulated tools should be used. If an external short circuit happens, check the short circuited cell prior to commissioning.

2. **Keep the battery cool and aerated**

Lead acid batteries produce hydrogen gas which can cause explosions, never smoke or have an open flame near a battery on charge. The recharging process could raise the battery temperature significantly, especially toward the end of charge. Insure that the battery location is well aerated and far from any heat source. Excessive temperature reduces battery life.

3. **Wear proper protective clothing**

Batteries contain sulfuric acid that can cause severe burns. Always wear a protective face shield, security glasses, rubber gloves and a rubber apron while inspecting and maintaining batteries. In case of contact with eyes or skin, flush immediately and thoroughly with clean water. Obtain medical attention when eyes are affected.

4. **Examine batteries upon receipt**

Look for signs of impact or leakage and notify Power Battery Co or your supplier immediately if there are signs damage during transit.

5. **Properly recycle spent lead acid batteries**

Spent lead acid batteries can be harmful if not handled and recycled properly. Contact Power Battery Co., or your distributor for proper battery recycling.



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Basic recommended maintenance instructions

1. **Maintain good maintenance habit and recording**

Simple monthly inspection and recording of voltage, specific gravity and temperature could prevent major repairs. The rate of electrolyte evaporation depends on factors such as temperature, daily depth of discharge, etc. After observing water loss for a few months, it may be possible to reduce the inspection rate to quarterly if the water loss is not significant for a two month period. A good quality Hydrometer and Volt meter are recommended for proper readings.

2. **Good Connection**

Make sure that all the connections of the cells and charger are in good condition. A loose connection can provoke a spark could trigger an explosion. Also, do not disconnect the battery from its charging source while the charging source is operating.

3. **Water addition**

The HPF series cells are provided with a high electrolyte reservoir above the plates and provided with a Water-Miser™ vent plug in order to minimize water loss caused by gassing during recharge and evaporation. However it's important to ensure during the monthly check up that the electrolyte level is at its maximum which means 1 centimeter (or 0.4 inch) below the internal chimney. Distilled water is strongly recommended for use.

4. **Keep the battery dry and clean**

Clean the battery during the monthly inspection, neutralize any acid traces with a weak alkaline solution (1 spoon of baking soda per liter of H₂O)

6. **Do not remove vent plug**

Keep the vent plug well in place during normal operation and especially during battery cleaning. Open the flip top cover only during the monthly inspection or for level verification, water addition or specific gravity readings.

7. **Avoid under/overcharge**

Overcharging a battery does not increase its capacity or performance but, on the contrary, it will reduce its service life. If excess temperature is detected check the battery and the charging system. An undercharged battery, or battery left in a discharged state, can result in permanent damage. Consult our charging section below.



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Service Manuel

BATTERY RECEPTION

Check carefully the battery for any apparent damage or acid leak caused by transport, if any, it should be reported to the carrier and to Power Battery for your claim. No replacement will be authorized unless clearly identified and documented prior acceptance of the goods.

STORAGE

All batteries are shipped fully charged. If not installed immediately, it must be stored in a dry, clean and cool warehouse. If storing period is extended, the battery must be recharged every 6 months or when cell voltage is lower than 2.07 volts (or whichever comes first). The voltage drop is a function of the warehouse temperature, the higher the temperature, the more rapid the voltage decrease and vice-versa.

BATTERY INSTALLATION

1. Check the electrolyte level, specific gravity corrected at 77°F (25°C) and voltage of every cell and record readings
2. Install the battery in the desired configuration while keeping in consideration the polarity of each unit in conformance to the installation plan. If installing into a battery compartment, make sure compartment is clean and corrosion free. A spill containment kit is strongly recommended to be in place before battery installation.
3. Brush the lead terminal with a steel brush and apply a thin layer of No-OX grease with a brush over the terminal surface as well as the cable lugs.
4. Connect the cells in accordance to the installation plan.
5. Tighten the bolts with a torque wrench to a value on 70 inch Lbs (8Nm).
6. Connect the battery to the charging system, we recommend constant voltage charger set at 2.4 V.P.C. with temperature compensation at 77°F (25°C)
7. Charge the battery completely prior to commissioning. Verify and record date of commissioning, specific gravity which should be around 1.270 +/- 0.005, temperature and voltage of every cell.



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OPERATION

1. Never discharge the battery more than 80% its nominal capacity or to less than 1.140 specific gravity.
2. If the battery temperature is constantly maintained above 115°F (46°C), permanent damage will occur to its internal components. Battery should be installed in a dry, cool, well aerated place.
3. Electrolyte level should be verified monthly. If the level just covers the separator protection it should be restored to 1 centimeter below the vent plug chimney. Water addition should always be done after recharge, to prevent acid spillage.
4. Keep the battery top always clean. Clean any spillage created during water addition.
5. The specific gravity of a fully charged cell is around 1.270 +/- 0.005 at 77°F (25°C). If temperature is above or below 77°F (25°C), a temperature correction to the specific gravity reading is as follows: for every 3°F (1.7°C) add or reduce 1 point to the reading if temperature is above or below 77°F (25°C). As an example, for a reading of 1.270 at 92°F, we have to add 5 points to the reading which will be 1.275 when corrected.
6. Charging & state of charge. In addition to checking the cell voltage for state of charge (figure 1), the Specific Gravity is a true measure of the battery's state of charge (figure 2). At approx. 77°F (25°C), specific gravity readings in comparison to the battery's state of charge are as follows:

State of Charge	2V Cell	12V	24V	48V
100%	2.10	12.60	25.20	50.40
75%	2.01	12.06	24.12	48.24
50%	1.93	11.58	23.16	46.32
25%	1.84	11.04	22.08	44.16
0%	1.75	10.5	21.00	42.00

Figure 1

State of Charge	Specific Gravity
100%	1.265 - 1.275
75%	1.230 - 1.240
50%	1.190 - 1.200
25%	1.145 - 1.155
0%	1.100 or below

Figure 2

When charging the Power Battery HPF series batteries using some form of renewable energy (Solar Panels, Wind Power...etc) an inverter and a UL certified charge controller must be used. There are three types of charging procedures: Absorption (or Bulk), Equalization and Float.

A. Absorption(Bulk). This is a daily charge used to bring batteries back up to a higher state of charge after it has been discharged. Charger setting should be 2.4 – 2.5 Volts per cell Maximum. After this stage, the Float charge is used.

B. Float. This will maintain the battery to stay at full charge. The lowest recommended float charge setting is ideal to reduce water loss of the cell. Float charger setting will range from 2.20 – 2.23 VPC. Maximum charge current is 13% of the 100 AH rate. Example, 500AH battery will take a maximum of 13% current (13% of 500 = 65 amps).

C. Equalization. There are two types of equalization, Preventative/Regular equalization and Corrective equalization. Preventative equalization shall be performed every 30 days for approximately 2-3 hours at 2.55 – 2.65 VPC. This will “equalize” the cells voltage and specific gravity to be in unison. Corrective equalization shall only be performed if the battery bank is undercharged: will not charge above 50% or will not hold a charge at all. This is a result of a heavily sulfated battery. During the Corrective equalization, temperature should ALWAYS be closely monitored and kept below 125°F (52°C). Set charging voltage to the highest recommended as per figure 3. A low current is recommended (approx. 5 Amps per 100AH). A heavily sulfated battery may take hours for the specific gravity to start to rise. As the gravity begins to rise, continue to monitor the Temperature. If the Temperature reaches near 125°F (52°C), lower the charge current or remove the charge current to let batteries cool. When the specific gravity reached 1.265, charge for another 1-2 hours and add water to cells where necessary. Allow battery bank to cool before it should be put back into use.

Type of Charge	Volts Per Cell (VPC)		12 Volt Bank		24 Volt Bank		48 Volt Bank	
	Min	Max	Min	Max	Min	Max	Min	Max
Float*	2.20	2.23	13.20	13.40	26.40	26.80	52.80	53.50
Absorbtion/Bulk	2.40	2.50	14.40	15.00	28.80	30.00	57.60	60.00
Equalization	2.55	2.65	15.30	15.90	30.60	31.80	61.20	63.60

Figure 3

7. Environment temperature correction scale: add or reduce the volts per cell plus or minus 2.8 Millivolt per degree F (5 millivolt per degree C).
8. If the specific gravity of a cell differs by more than 20 points above or below average and remains unchanged for 4 weeks, this cell will require specific gravity adjustment by adding water or acid depending on its condition.
9. Inspect annually conditions of the cables and connections. Repair or change any damaged cables and re-torque at 65 inch Lbs.
10. Maintain the monthly record of specific gravity, temperature and voltage reading of every cell.

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TROUBLESHOOTING

The Power HPF Series is designed to give many years of trouble-free service when properly maintained and charged. Failure to follow operating and maintenance guidelines will result in poor performance and/or premature failure. The following addresses typical errors in operation and maintenance.

<i>Battery Condition</i>	<i>Check For</i>
Poor Battery Performance	<ul style="list-style-type: none"> • Undercharged Battery • Sulfated Battery • Low Electrolyte • Loose or defective connectors or cables • Low Temperature Operating Environment - 32°F (0°C) or below reduces battery capacity) • Batteries are old
Low or Unequal Specific Gravities	<ul style="list-style-type: none"> • Undercharging • Over-filling
Excessive Watering	<ul style="list-style-type: none"> • Overcharging • Container Leak • Old Batteries
Odor During Charging	<ul style="list-style-type: none"> • Low Electrolyte • Overcharging
High Battery Temperature	<ul style="list-style-type: none"> • Overcharging • Opportunity Charging • Battery Overworked

For further technical information or MSDS, contact Power Battery Company Inc.

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