CROWN®
BATTERY
SINCE 1926

Industrial Battery Care

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Basic Battery Care

- Add water as needed - do not overfill.
- Always keep electrolyte level above separator protectors.
- Keep vent caps tightly in place.
- Charge battery on properly matched charger.
- Allow battery to cool down before placing it back into service.
- Keep battery top clean, dry and free of foreign objects.
- Keep battery and truck cover open during charging.
- Batteries produce explosive gases. Keep flame and sparks away from battery.
- Do not discharge beyond 80% (1.140 -1.160 SP.GR.)
- Report any problems or damage. Minor problems can become major ones.
- Good battery care is not a luxury, it's a necessity!!

Industrial Battery Care

Today's industrial battery is designed and built to give anywhere from 1000 to 2000 operation / charge cycles, depending on the application and the operating environment. If such a battery were to complete on cycle per workday, the life expectance would be 4 to 8 years. Exactly how much life a battery will provide depends to a great extent on how well you take care of your battery. The following maintenance procedures, properly carried out at the proper time, will go a long way toward prolonging the life of the battery and making it more efficient.

Routine battery maintenance consists of three functions:

1. Properly charging batteries
2. Adding water as needed
3. Cleaning as required

Instruments for Inspecting Batteries

Three testing instruments are required to check batteries accurately and efficiently: a voltmeter, hydrometer, and thermometer. The specific gravity and open circuit voltage readings are normally in direct proportion to each other; therefore, a voltmeter or hydrometer can be used to check the battery. The use of the voltmeter is a faster method of approximating the individual cell state of charge, and can reduce dramatically the time required for routine battery checking. When using the voltmeter method of battery checking, take specific gravity readings on the two cells having the highest and lowest voltage readings. This will confirm both cells' state of charge and accurately pinpoint the difference in the state of charge between them. The voltmeter is used when on–charge or on–discharge voltage readings are needed.

A battery thermometer is read like a normal thermometer. A proper thermometer should have specific gravity correction marked on its scale.

The hydrometer has an extra–long scale to make readings more accurate. For ease of correcting for temperature, the specific gravity corrections are marked on the scale of the thermometer. The cell tester (voltmeter) has a 1.5 to 3.0 volt scale, and an easy–to–handle, one–piece terminal probe.

By far, the most important part of routine maintenance is the proper charging of the batteries. Generally speaking, lead–acid batteries may be charged at any rate of current which does not cause excessive "gassing" of the electrolyte, and does not produce temperatures in excess of 115 degrees F. (125 degrees F. is acceptable for infrequent, short periods). Fortunately, today's automatic voltage controlled chargers take the guess–work out of charging. Providing the battery is well maintained, all that is necessary for routine charging is knowledge that the charger is functioning properly. This is accomplished be periodic inspection and adjustment of the equipment. Periodic inspection and adjustment of the charging equipment can be performed by an outside professional charger repairman. However, a basic knowledge of what is involved in the charging operation, plus a brief description of the more important types of charging and when they should be used, should provide valuable information in the event of automatic charger malfunction, or for charging operations not using fully automatic equipment.

Battery Maintenance - Part 1 of 3 (Charging Information)

Types of Charging

There are number of different charging methods; although only four need explanation. These are a Freshening Charge, Cycle Charging, Equalizing Charging and a new charging concept, called Opportunity Rapid Charging.

Cycle Charge

Cycle charging is the complete recharging of a battery after it has been fully or partially discharged during normal operations. Typically, a cycle charge is based on an 8-hour time period that recharges the battery and restores it to a fully charged condition.

Equalizing Charge

Each cell in a battery is an individual; each has a slight difference in uniformity in construction and content. The slight differences cause some cells to take less charge then the other cells in the battery. Over a period of time, the state of charge of some cells will require more charge then the other cells. To correct this condition, an equalize charge is given as it extends the charge cycle beyond the normal 8 hour charge period. This is typically for an additional 3 hours, at a very low rate. This allows the weaker cells that drift back in capacity and will limit the battery from delivering its full capacity potential. To bring all the cells back to an equal state of charge, the battery must be given an equalizing charge. An equalizing charge should be given at the end of each workweek. This will allow the battery to become fully charged and provide ample cool down time before the beginning of the next week.

Freshening Charge

A freshening charge is used to bring a new battery to a fully charged condition before it is placed into service, or when a battery has been standing idle for a short time period. A freshening charge is typically a soft charge at a low output (3 to 6 amperes per 100 ampere hours of the battery's rated capacity) for approximately 3 hours. This allows the battery to be restored to a fully charged condition maximizing the battery's electrical storage capability. All new batteries should receive a freshening charge before placing the battery into service.

The Charging Process

When a battery is placed on charge, the opposite reaction of battery discharge takes place; that is, the sulfate in the active material of the plates in driven back into the electrolyte. This reduces the sulfate in the plates and increases the specific gravity of the electrolyte, an electrochemical process which continues until the on-charge cell voltages reach 2.50 to 2.70 volts per cell, dependent upon the type of charging equipment used.

Finish rate or "normal" rate is that current which can be used safely any time charging is required, and which can be continued after the completion of the charge without causing excessive gassing or high temperature resulting from overcharge. The finish rate is shown on the nameplate of Crown Batteries.

Generally speaking, it is 3.5 amperes per 100 hours of the battery's 6-hour rate capacity. A partially, or completely discharged battery can safely handle currents much higher than the finish rate, but as it approaches full charge, whatever charging rate is used must be reduced to the finish rate. The curves are typical of the recharge of an 18-cell battery, which was discharged 100 ampere hours, and shows specific gravity, current, voltage and cell temperature. Note that after approximately 5 hours of charge, when the battery if about 85% of its nominal full charge, the charging current is reduced sharply to a level which is maintained until charging is complete. Then the battery is fully charged, the current is stopped or should be reduced to a very low rate.

Determining if a Battery is Properly Charged

If the battery charging equipment is functioning properly, and if the battery is in a healthy condition, there is little chance for an improperly charged battery. If some doubt about its operation exists, the following checks are a quick way of determining a proper, fully charged battery.

1. Charging current readings will level off to the finishing rate.
2. Charging voltage stabilizes.
3. No rise in specific gravity.
4. Normal gassing.

Overcharging

An excessive amount of charge results in high battery temperature, reducing the battery's service life.

Overheating

To obtain maximum service life from a battery, it should be charged and operated at temperatures below 115 degrees F. Above this temperature, overheating occurs. Overheating can damage the battery and shorten its normal expected service life. The extent of the damage and service life loss depends on how high the temperature, how often the overheating occurs, and how long the batteries are subjected to high temperatures.

A healthy battery charged on a properly functioning charger will have a 10 to 20 degree F. rise in temperature when fully charged from a completely discharged state. What causes a battery to go beyond this range and overheat? The temperature rise is affected by several variable factors:

1. Age and condition of the battery
2. Battery temperature compared to ambient temperature
3. Start, intermediate and finish rate of the charger
4. The amount of overcharge given the battery

In lift truck operations, a battery can overheat because of the operating requirements of the truck, as well as the operating environment. If a lift truck requires almost continuous current draws that are higher than normal, the temperature will rise. Ideally, for this operation, a "cool" battery whose temperature is 90 degrees F. or lower should be installed in the truck. However, if the lift truck operator starts with an overheated battery whose temperature is above 115 degrees F., the continuous high current draws will tend to make the temperature rise even higher and battery damage is likely.

Typical working environment where batteries must operate in an overheated condition are in a foundry, where ambient temperatures reach 120 degrees F. and higher; and in heavy-duty operations where they must be charged every 5 to 6 hours with no time for cooling before charge. The latter problem can often be alleviated by having more than two batteries per truck. For the former, an inexpensive way to cool the battery is by directing a fan over its inter cell connectors and since the conduct 60% of the heat out of the battery, the battery will cool rapidly. Charge with battery covers open. Operating and charging batteries at elevated temperatures is a frequent cause of battery damage and reduced service life. An experienced lift truck battery man, given the levels of operation and charging temperatures, and time span for which they are held, can estimate the percentage of service life lost. The estimated loss expressed as a percent, can serve as the basis for deciding whether to invest in extra batteries, higher capacity batteries or battery cooling equipment.

Keyed Connectors

Sometimes, batteries of several different voltages and ampere-hour capacities are charged at the same time at the same centralized location. Precautions must be taken to make sure that batteries are charged on chargers with mating voltages and ampere-hour ratings. Rather than rely on the persons placing the batteries on the chargers, we recommend the use of plugs and connectors of different types or the use of keyed and color-coded connectors.

Gassing

When a battery is charging, the electrolytic break down of the water in the electrolyte produces oxygen on the positive plates and hydrogen on the negative plates. This is normal. However, if a high charging rate is continued after the battery has been brought to its gassing voltage, the gassing becomes excessive, and abnormally larger amounts of hydrogen and oxygen gases are produced. The best indication of excessive gassing is a very noticeable "bubbling" action of the electrolyte and high electrolyte temperature.

Hydrogen is a highly combustible gas and will explode on ignition when is connection in air reaches any level between 4 percent and 74 percent. (Below 4% the concentration is too weak; above 74% there is not enough oxygen left in the air to support combustion.) If you have reason to suspect excessive gassing, troubleshoot the battery and charging equipment. An unusually high usage of water indicates that excessive gassing is occurring.

Undercharging

Undercharging a battery, even to a small degree, if continued, leads to excessive "sulfation". The same is true of batteries which have been left standing in an undercharged state for an extended period. High temperatures rapidly accelerate sulfation when batteries are left standing in a partially charged condition. The cells of a sulfated battery will give low specific gravity and open circuit voltage readings. On charge, voltage readings will be unusually high. The battery will not become fully charged after a single normal charging when sulfation has taken place over a prolonged period.

Opportunity Rapid Charge

New charger technology has been developed to allow batteries to be charged faster and at substantially higher charge rates, called Opportunity Rapid Charging or Fast Charging. Opportunity charging is charging the battery at every opportune time possible. The battery should be charged at breaks, lunches, and at the end of each shift and any other times when the battery can be charged for at least 10 minutes. Rapid charging is defined as charging the battery from 20% to 80% state of charge in two hours or less. By opportunity charging the battery the state of charge is maintained between 30% and 80% during the normal work shift. Once a day, the battery is allowed to recharge to 100% of its rated capacity. On weekends, the battery will be automatically equalize charged while it is still connected to the charger. Opportunity Rapid Charging can only be safely accomplished with a specially designed charger with sophisticated control capable of monitoring battery conditions.

Battery Maintenance - Part 2 of 3 (Adding Water)

Generally, a certain amount of water loss is normal in all batteries, and it should be replaced with “pure” tap water or distilled water. In some areas around the country, tap water may contain chemicals or other impurities harmful to batteries. If water is needed, add just enough to bring the electrolyte to the proper level. Batteries should be filled only at the end of the charging cycle. Overfilling is the most common error made when watering, and it can cause tray corrosion. Because tray corrosion can cause EXTENSIVE DAMAGE to batteries and vehicles, extreme caution must be taken to avoid overfilling the batteries.

Tray Corrosion

Most trays for motive power batteries are made of steel that is protected with an acid resistant coating. Regardless of how good the coating is, if a break in the coating exposes the steel tray to the sulfuric acid spilled from the battery, the acid will corrode the tray. How quickly the tray corrodes depends on how much and how often acid is spilled on top of the battery, and how often the battery is cleaned.

The major cause of tray corrosion is over watering or overfilling a battery. When overfilled, the electrolyte will spill on top of the battery. Although the water in the electrolyte will evaporate, the highly concentrated acid solution remains and gives the appearance of dampness. If the acid is not removed, the tray will eventually corrode. To prevent corrosion, batteries should be cleaned any time the accumulation of dampness or acid becomes significant.

A good technique to follow in watering batteries is to use a flashlight focused on the vent hole being watered. Visually, watch the level of the electrolyte rise, and stop watering the instant the proper level is reached. Each cell is filled in the same way. Cell filling equipment that automatically fills batteries to the proper level is available.

In addition to causing tray corrosion, the accumulation of acid in conjunction with the corrosion can cause grounds. Two significant grounds can create an external short through the case of the battery. As a result, some or all of the cells continually discharge. And as the current carrying ability of the multiple grounds increases, further complications such as jar leakage, overheating, cell failure, etc., can occur. Furthermore, grounds can also cause serious problems or failures in the electronic controls or electrical components of the vehicle.

To test for a ground in a battery, set the voltmeter to handle the sill open circuit voltage of the battery being tested. Place the positive probe on the positive Terminal of the battery and the negative probe on the spot of the steel tray where bare steel is exposed. Make sure that the negative probe penetrates the paint to the steel. To detect the location of the ground, move the positive probe from intercell to intercell connector until the lowest voltage reading is found. This will be the grounded cell. To clear the ground, clean the top of the battery of acid and corrosion and dry. If the ground is still present, reseal the battery with a sphaltic compound.

Watering Schedule

Low electrolyte level in a cell can cause the plates to oxidize and shorten the life of the cell and the battery. To prevent this needless and wasteful damage, water should be added often enough to keep the electrolyte level above the perforated separator protectors. Ideally, a watering policy or schedule should be adopted and followed strictly. One of two systems can be used. In the first, the electrolyte level of two or three cells is checked each time the battery is charged. In the second, water is added to all of the batteries assigned to each charging area on a regular time schedule. The electrolyte levels are also spot checked periodically to determine if the proper levels are being maintained, if the second method is used.

Determining a reasonable and proper battery watering time schedule could be easy or difficult, depending on how widely the following three factors very:

1. Frequency of charge (daily, 1 ½ times a day, three times a week, etc.).
2. Water storage capacity of the specific cell type.
3. Age and condition of the battery.

Older batteries and those in poor condition will consume water more rapidly than newer batteries and those in good condition. Also some cell types have a greater water storage capacity than others.

Depending on the preceding variable factors, the batteries assigned to a specific charging area will require watering at different intervals. The frequency of watering is best determined by first-hand experience. Example: If some batteries have low electrolyte levels when a weekly watering schedule is followed, change the schedule to twice a week.

Battery maintenance - Part 3 of 3 (Cleaning)

To prevent corrosion and the resultant problems, batteries must be cleaned and dried routinely.

Sometimes minor spills or overflows of electrolyte occur due to overfilling. Instead of giving the battery a general cleaning at this time, the moisture can be removed with rags or paper towels. (This should be immediately disposed of.)

The frequency of a general cleaning depends upon two factors:

1. How quickly dust, dirt, oil, and other foreign matter accumulates on the top of the battery, and
2. How quick the electrolyte spillage accumulates.

When the top of a battery is "dirty" or looks damp, it is ready for a general cleaning. It could be as often as every two weeks or as infrequent as every six months, depending on the battery's environment and the care it receives. The average battery needs general cleaning every three months.

To give a battery a general cleaning, use hot water(130 degrees F. to 170 degrees F.) with a neutralizing detergent solution. The neutralizer / detergent solution is made by mixing ½ pound of baking soda, or ½ pint of household ammonia, with the recommended amount of detergent for general cleaning with one gallon of clear water.

Apply the solution with a clean paint brush to the top of the battery, working it under the intercell connectors and the terminals to loosen the grime and neutralize the acid. If baking soda is in the solution, apply the mixture until the "fizzing" action stops. (An ammonia solution will not "fizz".) Then rinse the battery with clean, hot water from a low pressure hose to remove all traces of the solution and loose dirt. Cold water works, but hot water cleans better.

During any cleaning, but particularly when using a neutralizer / detergent solution, make certain that all vent caps are tightly in place.

Crown Battery Warranty Service and Support for the Province of BC

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