SEBANG GLOBAL BATTERY

Instruction Manual For Electric Traction Batteries

Introduction of Batteries

1. What is battery?

Battery is an electrical device which converts electrical energy into chemical energy and preserves it and then takes it out as electrical energy and uses it as necessary ; the difference from primary battery(e.g. manganese battery) is that the reaction is reversible. At this time, the work of taking out electrical energy from battery is called electric discharge and the work of putting electrical energy into battery as chemical energy is called electric charging.

2. Why batteries are used for forklift?

Because the clad type lead-acid batteries have following advantages compared to other electrical devices.

(1) It is cordless power source.
It has a big advantage of supplying great power to the place without power cable, wiring, etc.

(2) It is pure DC power.
It supplies good power for thyristor circuit or motor circuit which is used for speed regulation.

(3) It has high performance and long life.
It maintains high performance for long hours and its components endure vibration and shock sufficiently, so it can be used without anxiety.

(4) It is noiseless safe power source.
It is a power source for preventing pollution, which does not generate vibration, noise, harmful gas flame, etc.

(5) It is economical and easy to handle.
It can be maintained and controlled sufficiently by person who handle it for the first time, and it has no trouble for long time; its consumables are only the refined water which is contained in electrolyte.

3. Structure of battery(cell)

Battery consists of positive plate and negative plate to store electrical energy, separator to prevent short circuit in both electric plates, electrolyte to be electric conductor and acting part, container of special plastic material to contain these, cover, pole to be entrance of electrical energy, other accessories, etc.

(1) Positive plate: Tube is inserted into the core metal of lead-alloy grid, active material(lead(II) carbonate hydroxide) is charged between the tube and core metal, but the bottom side of tube is blocked by sealer in order to prevent active material from being removed. This electric plate is called a clad type positive plate, which exerts long life and high performance.

(2) Negative plate: It is the lead-alloy grid pasted with active material(lead(II) carbonate hydroxide and special chemicals mixed with weak sulfuric acid), which is called a pasted negative plate.

(3) Electrolyte: Electrolyte used in battery is the high-purity colorless odorless strong sulfuric acid mixed with refined water; and its specific gravity in fully charged state at specified liquid level is 1.280/25℃ as a standard.

(4) Separator: It has excellent acid resistance and oxidation resistance, long life span, and small electric resistance.

Caution Regarding Safety

Proper handling, maintenance, and checking are important in order to use battery safely. In this instruction manual, matters having worry of being connected to life accident to user if it is not observed are indicated in 3 steps of safety classes such as danger, warning, and caution. Please read carefully the content of text.

1. Safety Class / Danger

It indicates a content which is expected to cause a danger of receiving death or serious wound if the content is ignored or treated wrong.

2. Safety Class / Warning

It indicates a content which is expected to cause a high possibility of slight wound or material damage as well as death or serious wound if this content is ignored and treated wrong.

3. Safety Class / Caution!

It indicates a content which is expected to cause a material damage only as well as a risk of receiving slight wound even though there is little possibility of receiving serious wound if the content is ignored or treated wrong.

The above mentioned serious wound refers to a wound requiring hospitalization and long term consultation with a doctor for medical treatment as well as a wound leaving aftermath due to eyesight loss, wound, burn, electric shock, fracture, poisoning, etc. Slight wound refers to wound, burn, electric shock, etc. which does not correspond to serious wound. Material damage refers to wide range damage to house, property, equipment, etc.

Safety Counterplan and Caution

1. Danger of Explosion or Fire due to Hydrogen Gas

※ Safety class / Warning! Risk of explosion! No fire!

Battery generates combustible hydrogen gas. Sparking battery or making battery approach a fire heat can cause fire or explosion.

Please follow the instruction regarding treatment below.

(1) Do not use or charge battery at a sealed place or a place which is badly ventilated.

(2) Do not cause short circuit or spark to battery and do not make battery approach a fire heat such as cigarette light, etc. When charging battery, perform charging after opening the battery cover of forklift.

(3) Do not install battery near the places such as heating agent(transformer, etc.), flame from spark generating things (grinder, switch, fuse, metal processing machine), or welding flame.

(4) Do not attach or detach the plug when electricity flows.

(5) Do not make short circuit with joining tools such as bolt or nut, etc. between terminals of battery.

2. Electric Shock due to Connection with Conductor Part

※ Safety class / Danger! Caution risk of Electric Shock !

Because battery is in high voltage, connecting of human body with conductor part during installation, maintenance, or check can cause burn due to electric shock. During maintenance or check, wear protection tools such as rubber glove, rubber boots, etc. and use tools around which insulation tape is sufficiently wound.

3. Burn or Eyesight Loss due to Sulfuric Acid

※ Safety Class / Danger! Wear protection tools! Caution risk of Electrolyte!

(1) Electrolyte for battery is sulfuric acid, so if electrolyte enters into eyes, wash your face with a lot of clean water and then consult a doctor specializing in eyes. This can be cause of eyesight loss. During maintenance or check, wear protection tools such as protection goggles, rubber gloves, etc. by all means.

(2) Electrolyte for battery is sulfuric acid, so if electrolyte contacts with skin and body, wash it with a lot of water immediately and then wash it sufficiently with soapy water. This can be cause of burn.

(3) If it is attached to clothes, take it off quickly, wash it with a lot of water immediately, and then wash it sufficiently with soapy water. This can be cause of burn.

(4) If electrolyte enters into mouth or is drunken, repeat brushing your teeth with a lot of drinking water immediately and then drink a lot of drinking water and milk. And then, consult a doctor immediately. This can be cause of burn.

4. Explosion due to Static Electricity

※ Safety Class / Danger! Risk of Explosion!

(1) Do not clean battery surface and connection part with dry cloth or duster. The combustible gas which generated from battery can be cause of explosion due to static electricity. The top part of battery shall be cleaned with wet cloth, etc.

(2) Do not cover battery with cloth kind, etc. which generates static electricity. Because battery generates combustible gas, this can be cause of explosion due to static electricity.

(3) For checking and cleaning of battery, separate battery from charger, open battery cap, perform ventilation sufficiently, remove static electricity in your body by touching metal part, and then start it.

5. Safe Handling of Battery

※ Safety class / Danger! Risk of explosion! Risk of electric shock!

When handling battery, pay attention to the following matters for safety.

(1) Do not throw battery into fire or heat battery. This can be cause of liquid leakage, heating, or rupture of battery.

(2) In the following cases by checking battery, do not use it as it is. This can be cause of firing, heating, or ignited explosion of battery due to spark generation and heating. Receive diagnosis from seller by all means.

* Abnormal smell occurs from battery. Liquid is dark. Electrolyte temperature is high. Liquid quantity reduction phenomenon is distinguishing.
* In case that connection part of electric cable is damaged
* In case that end part of electric cable integrated with terminals is corroded
* In case that there is marks of deformation or heating in plug part

(3) Do not make contaminants or foreign materials attached to battery surface or connection part. This can be cause of combustible explosion or fire due to electric leakage. Wipe out contaminants and foreign materials cleanly with wet cloth, etc., clean battery, and then keep the battery in dry condition.

(4) Keep battery away from children. This can be cause of burn, loss of eyesight, or electric shock due to sulfuric acid.

(5) Replace the battery being used for long time with new battery as a result of regular check. Late replacement can be cause of explosion due to aging of internal part.

6. Careless Handling

※ Safety class / warning!

Do not abstract, disassemble, or repair liquid of battery at your discretion. This can be cause of heating or fire.

Essential Points in Maintenance and Handling

1. Avoid overcharging or deficient charging.
2. Make electrolyte temperature not exceed 55℃.
3. Check electrolyte level once a week and, if the level is minimum, supplement refined water.
4. Keep the surface of battery clean and dry at all time.

Measures before Starting Use

1. Unpacking , Check

※ Safety class / Warning!

(1) Before using battery, check if there is no abnormality such as liquid leakage, heating, etc. Using such abnormality as it is can corrode car flame and battery top part or can cause electric leakage or fire.

(2) Before use, check if charging plug and cable was not damaged. Such damage can cause fire.

(3) Check if the battery corresponds to the type designated for the vehicle used. Using unsuitable battery can cause the lack of performance and the damage to vehicle during operation.

▶ Before use, perform supplementary charging(refer to the items of uniform charging). If battery is purchased in dry condition, inject the specified weak sulfuric acid(1.280/25℃) up to normal liquid level of battery. Start supplementary charging after weak sulfuric acid temperature inside battery drops below 35℃ after injection.

"Never apply charger in the state that liquid is not injected into dry state battery. This can be cause of explosion."

▶ Electrolyte of battery is shipped by being adjusted in full charging status, but liquid level may drop due to vibration or shock, etc.during transportation, so check electrolyte level of entire cell after finishing supplementary charging and then check if it is proper.

2. Installation and Connection

※ Safety Class / Warning!

(1) Persons who did not sufficiently understand handling method and danger of battery may not be allowed to install or connect battery.

(2) Contact seller for replacement work of cell. Mistake in replacement work can be cause of damage to battery.

(3) Do not turn over or drop battery. Flowing-out of electrolyte can be cause of damage and trouble to battery and vehicle.

Daily Maintenance and Handling

1. Discharge

※ Safety Class / Warning!

(1) During electric discharge, perform electric discharge with current not exceeding 2 times the rated capacity. Cutting of conductor part inside the battery can be cause of explosion.

(2) During operation of electric car, do not perform electric discharge below limit of BDI(Battery discharge indicator). This can cause voltage deviation of battery or ends the battery life early.(do not discharge electricity below 80% of battery capacity.)

(3) If much load is consumed with electric cars which are operated in excessive use condition or are remodeled, use batteries of a little bigger capacity as compared to the general capacity.

2. Charge

※ Safety Class / Warning! Caution!

(1) Charge battery with private charger or a charger suitable for rated capacity and voltage of battery.

(2) During charging, maintain electrolyte temperature below 55°C. Rising of electrolyte can be cause of burn due to liquid leakage. Pay special attention during charging under summer season and under the rays of the sun.

(3) Do not change maximum voltage of charger without consulting with maker. If input voltage is excessively high, battery is overcharged in order to be cause of temperature rise and life shortening.

(4) Do not install charger where ventilation bad, where temperature and humidity are high, where rain is much, or where corrosive gas exists.

(5) Do not allow access of fire heat(lighter, cigarette light, grinder/welder flame, etc.) when charging battery. This can be cause of explosion.

(6) Do not perform overcharging(exceeding 125% of discharge quantity). This can be cause of heating or life shortening of battery.

▶ The discharged battery shall be charged as quickly as possible.

▶ Charging ends automatically according to timer. Proper charging finishing standard is displayed as follows.

(a) When specific gravity of electrolyte after finishing charging displays about 1.280(25°C)

(b) When 110~125% electric quantity(Ah) of previous discharge quantity, if it is known, is charged

(c) When cell voltage reaches maximum value and then displays constant value for at least 1 hour

▶ Because overcharging and deficient charging can be cause of life shortening, perform proper charging.
Methods of performing proper charging are as follows.
(a) Select a charger suitable for battery capacity.
(b) Set up a charger tap voltage suitable for applicable voltage.
(c) Set up timer time(in case of manual timer).

▶ Using battery at high temperature shortens its life span, so prevent electrolyte temperature from exceeding 55℃.
Because temperature is liable to rise during charging, if temperature exceeds 55℃, suspend charging for a moment or cool it compulsively using ventilator, etc. in order to prevent temperature rise.
Even in inevitable case, prevent temperature from rising above 55℃.

▶ Battery generates a lot of gas during charging and increases its temperature due to heating by electrolysis of water, so open the forklift battery cover during charging by all means.

▶ When charging battery in the room, perform ventilation and air change sufficiently. Even during use or leaving, pay attention to ventilation and air change.

▶ When using battery at low temperature, maintain electrolyte temperature above a minimum of –15℃. If electrolyte temperature of battery drops below 5℃, internal resistance of battery increases rapidly and charging efficiency decreases, so it is needed to regulate charging quantity according to temperature.
Accordingly, low temperature region needs installation and operation of separate charger room, and proper charging room temperature shall maintain 5~25℃.

Electrolyte temperature(℃)	Charging quantity(%)	Electrolyte temperature(℃)	Charging quantity(%)
5~25	110~125	-15~-10	140~150
-10~5	125~140	-15 or less	Uncharged

3. Uniform Charging

For batteries repeating charging and discharge every day, perform uniform charging about once a month according to the instruction manual of charger.

4. Supplementary Charging

Battery reduces its capacity slowly due to self discharge even though it is not used. Perform supplementary charging about once a month according to the item of uniform charging.

(Reference)

1. Proper range of leakage type charger

1) Initial current : 16~22A or less per 100AH
2) Last current : 3-4A or less per 100AH
3) Charging last voltage : Within 63V/48V
4) Charging quantity : 105~110%(as compared to discharge quantity)
5) Charging time : 8Hr~10Hr
6) Battery specific gravity : 1.280± 0.01/25 °C maintained
7) Battery temperature rise during charging : 55 °C or less maintained
8) Idle output voltage control

2. Proper range of SCR charger

1) Initial current : 16A or less per100AH
2) Charging last voltage : Within 62~63V/48V
3) Charging quantity : 105~110%(As compared to discharge quantity)
4) Charging time : 8Hr~10Hr
5) Battery specific gravity : 1.280± 0.01/25 °C maintained
6)Battery temperature rise during charging : 55 °C or less maintained

5. Liquid Level Check and Maintenance

※ Safety class / Warning! Caution!

(1) Do not let electrolyte lower below minimum liquid level. Batteries whose liquid level is lowered because refined water is not supplemented can be heated or exploded.

(2) Lowering of liquid level below pole plate can reduce life span. Maintain liquid level between maximum liquid level line and minimum liquid level line by all means and check liquid level once a week.

(3) Supplement refined water up to designated liquid level. In case of performing maintenance by lengthening maintenance intervals, do not put refined water excessively. Excessive putting of refined water can make electrolyte overflow so as to cause corrosion in electrical equipment of forklift, discoloration of cap, reduction of specific gravity of electrolyte, etc.

(4) Do not put other foreign materials than refined water into battery. Entering of impurities into battery can cause heating, firing, or toxic gas generation.

(5) Checking and handling of battery shall not be performed by other persons than learner, skilled man, expert, or service person in checking and maintenance. This can be cause of electric shock accident.

▶ Lowering of liquid level due to lack of maintenance can cause shortening of life span. Because electrolyte reduces water content due to electrolysis during charging, supplement refined water after finishing charging in order to maintain liquid level between maximum liquid level and minimum liquid level at all time. Control the method of electrolyte maintenance due to water leakage or over-supplementing of liquid, etc. by referring to the following figure.

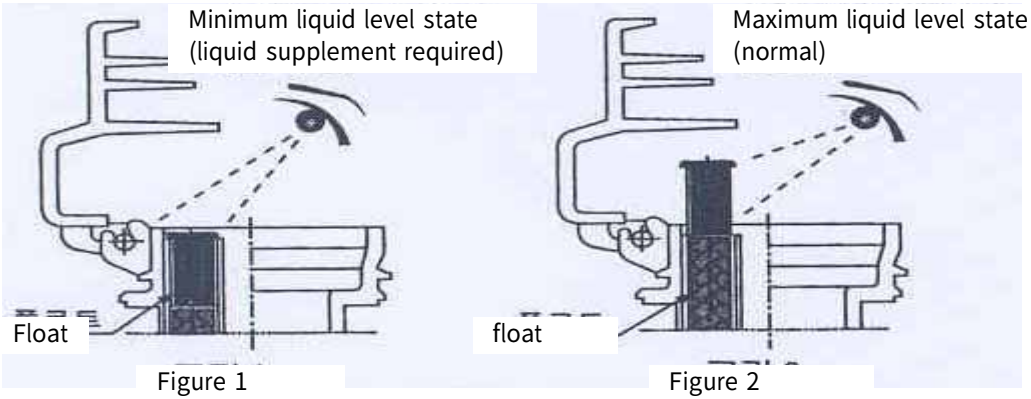

Figure 1 Figure 2

· If float is at minimum liquid level(figure 1), supplement refined water quickly.

· If float rises during injection of liquid so that rugged part of float is seen or if it reaches the upper and lower color change point(figure 2), suspend supplementing refined water(electrolyte is maintained between maximum liquid level and minimum liquid level at all time).

6. Liquid Level Detection Device(limited to option)

※ Safety class / Caution!

(1) Do not change the electric pole part attaching position of liquid level detection device. Damage and malfunction of liquid level detection device can be cause of battery badness.

(2) L.E.D of display part main body flickers in liquid level detection device. If the red L.E.D attached to the display part of liquid level detection device flickers, electrolyte level is reduced, so repair it according to the above figure.

Liquid level state	Green luminous lamp	Red luminous lamp
Stays at proper state. Reduced to need maintenance.	Turned on Turned on	Turned off Flickering

Measurement of electrolyte specific gravity

It is possible to recognize battery condition according to measurement of electrolyte specific gravity. Specific gravity of electrolyte shall be measured once a month first[about 1.280/25°C in case of full charging] and shall be checked about whether it is in normal state. Specific gravity of electrolyte shall be based on 25°C, so convert and use the following formula.

$$D25 = Dt + 0.0007(t - 25)$$

Where, D25 : Specific gravity converted to 25°C

Dt : Specific gravity at t°C

t : Electrolyte temperature(°C) when measuring specific gravity

Cleaning

Attachment of foreign materials to the top or connection part of battery can be cause of explosion and fire due to electric leakage, etc. Clean the dirty materials and foreign materials with wet cloth, etc. and keep battery and the surroundings at clean and dry condition.

※ Safety class / Caution!

(1) Do not have battery stained with organic solvents like benzene, thinner, gasoline, etc., and detergent, chemicals, etc. or do not use it for cleaning. This can be cause of battery damage due to organic solvent or electrolyte leakage.

(2) Do not wash battery using water with battery installed. This can be cause of damage to vehicles. Unload battery from car flame, wash it with water by closing liquid injection cap so that water may not enter into the inside of battery, clean it, dry it sufficiently, and then load it.

Caution in Use Environment

(1) In case of not using battery for long time, do not keep it where ventilation is bad or where ventilation exists. This can be cause of explosion due to staying of combustible, explosive gas.

(2) In case of suspending use for at least 3 days, perform uniform charging. If it is left with being charged, it can be damaged by being frozen at low temperature.

(3) Do not use battery with electrolyte temperature being away from –15℃ ~ 55℃ range. Using battery at other range than this temperature range can result in freezing or overheating in order to be cause of damage or deformation.

(4) Do not have battery get in touch with rain or sea water. This can be cause of damage or fire of battery.

Regular Checking

(1) Perform regular checking for liquid level, voltage, specific gravity, battery temperature, external appearance, and plug. This can be cause of ignited explosion, fire, or damage to battery.

(2) If battery, liquid injection device, plug, maintenance equipment, etc. is damaged, consult with manufacturer and then replace it according to countermeasures. And request seller to replace plug of battery. Late replacement can cause explosion, fire, or damage to battery.

Caution in Daily Handling

※ Safety class / Risk of explosion!

(1) When pulling out plug, turn off all of the key switch of vehicle and the switch of charger. Pulling out the plug in switched-on state can cause fire or combustible explosion due to generation of electric spark.

(2) In case of attaching cable, do not make connection by interchange +terminal and –terminal. This can cause damage or loss to electronic components.

(3) If cable and plug are damaged(connection part exposure, corrosion, heating in plug and cable, disconnection, etc.), replace it by consulting with seller.

(4) Do not modify plug or connection connector at your discretion. This can cause heating or explosion.

(5) Use plug with the plug connected completely. This can cause heating of plug.

(6) Do not have plug stained with dirty materials or foreign materials. This can cause heating of plug.

(7) Do not put metals like spanner, etc. on the battery. This can cause short circuit or damage due to short.

(8) Rigidly fix cable and battery terminals such as + or -. Insufficient fixing can result in performance reduction and spark in battery in order to cause explosion.

(9) If electrolyte is leaked, neutralize it with acid neutralizer immediately and then wash it with a lot of water. This can cause corrosion to battery and vehicle components.

(10) When keeping battery, do not put it at unstable places such as on swinging base, at sloped place, etc. or at place where dropping material or water flows.

(11) Do not use battery for other purpose than power source of electric cars. This can cause damage to battery and load side machine.

Others

(1) When not using battery, keep it in the cold dark room where ventilation is good without direct sunshine.

(2) When fire takes place, do not spray water on the battery. This can cause explosion. Use ABC powder fire extinguisher for fire extinguishing.

Abolition of Battery

Separately collect the batteries which ended use. Do not abolish battery as it is but consult with seller.