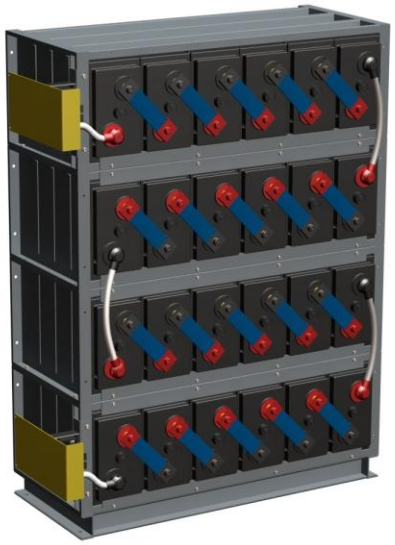
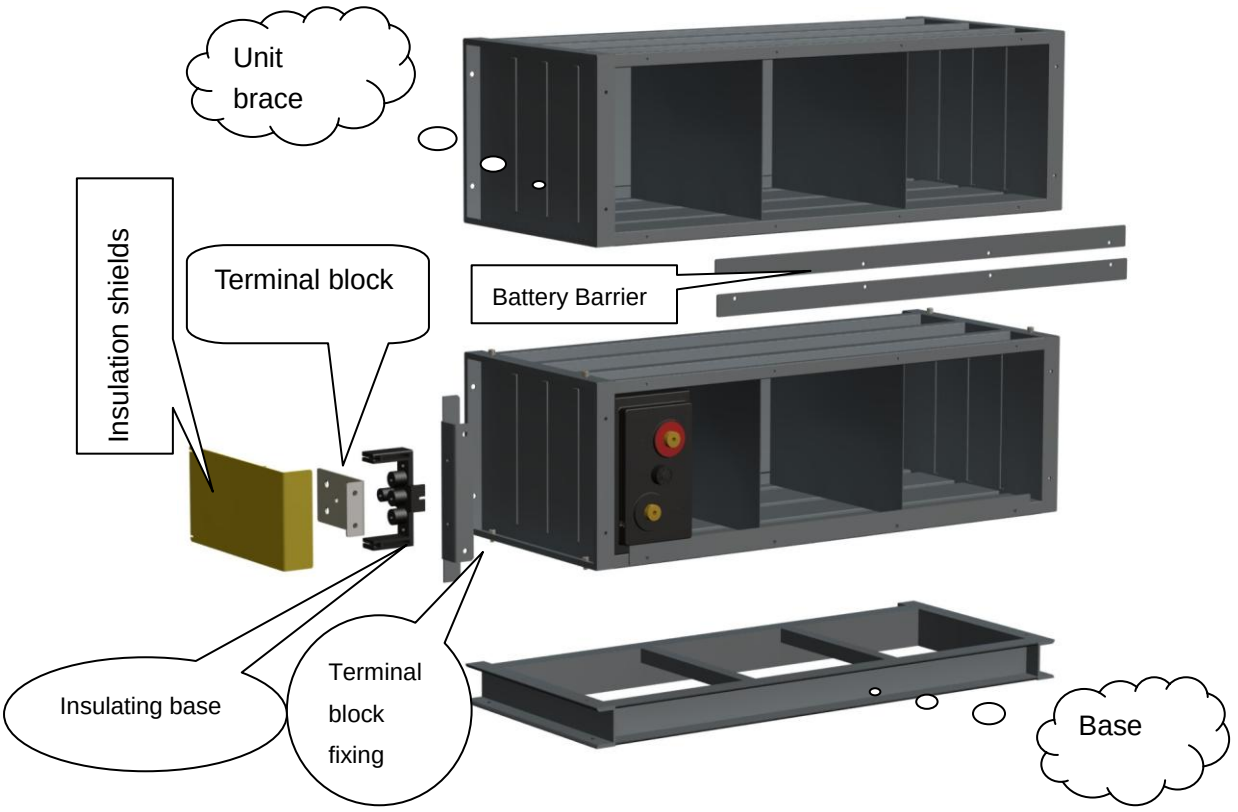
FCP Battery Installation and Operation Instruction



Shandong Sacred Sun Power Sources Co., Ltd.

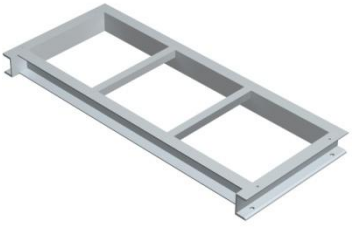
Contents

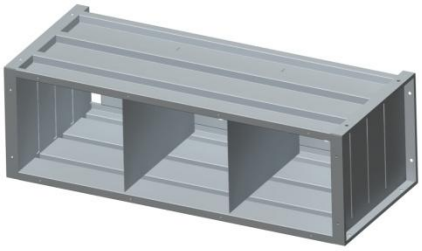
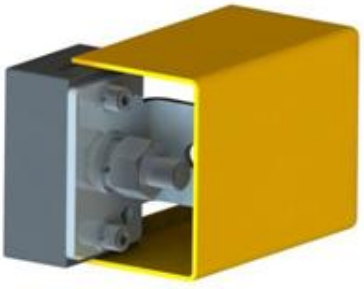
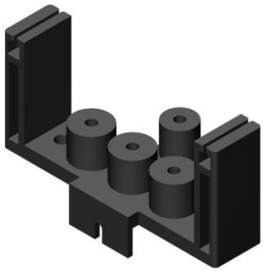
1. Battery mold decomposition diagram:



2. Battery accessories list

2.1 Rack accessories

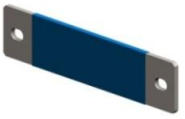
No.	Name	Type	Quantity	Remark
1	Base		1	

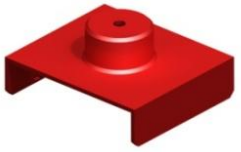
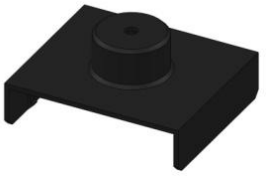
No.	Name	Type	Quantity	Remark
2	Unit brace		4	
3	Barrier	FCP-500: 218×24×4	12	218×24×4
		FCP-1000: 980×42×3	8	980×42×3
4	Terminal block fixing plate	J00109610102	2	
5	Insulating base	FCP-500 WX-195	2	
		FCP-1000 WX-121	2	

No.	Name	Type	Quantity	Remark
6	Terminal block	FCP-1000: J00109660100	**2**	
7	Insulation shields	FCP-1000 WX-122	**2**	
8	Fixing bolt	GB/T70.1-2008-M6×12	FCP-500: 25	1Bag
			FCP-1000:33	
	Flat washer	GB95-2002-C-Ø6	FCP-500:25	
			FCP-1000:33	
9	Fixing bolt	GB/T70.1-2008-M8×16	9	1Bag
	Flat washer	GB95-2002-C-Ø8	9	
	Spring washer	GB859-1987- Ø8	9	
10	Fixing bolt	GB/T70.1-2008-M8×16	13	1Bag
	Flat washer	GB95-2002-C-Ø8	26	
	Nut	GB/T41-2000-C-M8	13	
11	Fixing bolt	GB/T70.1-2008-M8×25	10	1Bag (only for FCP-1000)
	Flat washer	GB95-2002-C-Ø8	10	
	Spring washer	GB859-1987- Ø8	10	
12	Fixing bolt	GB/T70.1-2008-M8×25	2	1Bag (only for FCP-1000)
	Flat washer	GB95-2002-C-Ø8	4	
	Spring washer	GB859-1987- Ø8	2	
	Nut	GB/T41-2000-C-M8	2	
13	Fixing bolt	GB/T5781-2000-M14×40	4	1Bag (only for FCP-1000)
	Flat washer	GB95-2002-C-Ø14	8	
	Spring washer	GB859-1987- Ø14	4	
	Nut	GB/T41-2000-C-M14	4	
14	Steel bulge bolt	M10×80	4	1Bag
15	Installation manual		1 set	
16	Installation drawing		1	

No.	Name	Type	Quantity	Remark	
17	Ball hexagonal spanner	5#	1		
18	Insulated spanner	TB8	1		
19	Locating pins	WX-089	2		
20	Unloading valve tool	WX-251	1		
21	QC passed		1 set		
22	Packing list		1 set		

2.2 Connectors part

No.	Name	Type	Quantity	Remark
1	battery connection between layers	FCP-500: OX185/240 FCP-1000: OX185/380	3	
2	battery connection of output	FCP-500: OXD150/185 FCP-1000: OXD185/180	2	 
3	Rigid connector between batteries	FCP-500: 180×30×5	20	

No.	Name	Type	Quantity	Remark
		FCP-1000 224×50×5		
4	Protection for rigid connector	FCP-500: WX-249	42	 
		FCP-1000: WX-250		
5	Inner hexagon screw	GB/T70.1-200 8-M10×25	49	
6	Flat washer	GB95-2002-C- Ø10	49	
7	Spring washer	GB859-1987- Ø10	49	
8	Hexagon spanner	8#	1	**1Bag**
9	Packing list		1 set	
10	QC passed		1 set	
11	label (1 to 24)		1 set	
12	Battery connection drawing		1set	

3 Battery Rack installation procedures:

3.1 Unpacking Caution:

3.1.1 Battery mold rack is assembled before delivery, pay attention when unpacking to avoid mutual bump between components.

3.1.2 Unit mold rack needs individually stacking installation, this needs disassembled all molds during unpacking.

3.1.3 For easy installation, the battery mold rack can also be the whole installation, or more than one unit mold as large module decomposition before installation.

3.1.4 The bolts, flat washers, spring washers, nuts and other good which disassembled from the battery mold should be stored well for use when reinstalling.

3.2 Installation requirement

3.2.1 The distance between battery mold rack and wall should be greater than 100 mm; the distance between one ends of output line and wall should be more than 300 mm.

3.2.2 If conditions permit, the battery mold rack distance with walls, doors, equipment should be greater than 1000mm;

3.2.3 If the user is required, the battery mold rack can be configured grounding wire, drawn-out position is the expansion bolts at the bottom of the battery mold rack;

3.2.4 Battery mold rack using expansion bolts on the battery mold rack and ground fixed, in order to achieve the purpose of prevent shock.

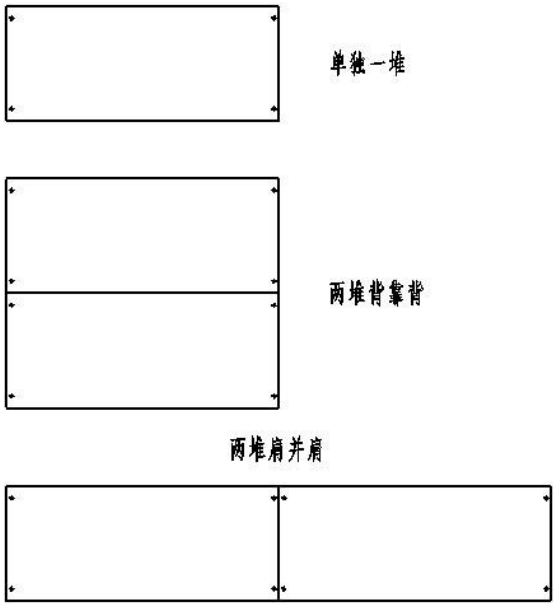
3.3 The placement location of battery mold rack:

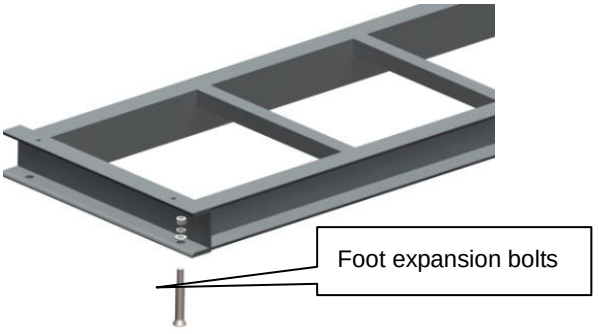
3.3.1 Referring to the installation size of battery mold rack, select the appropriate placement position, and cleared the ground.

3.3.2 Depending on the installation size of the battery mold rack on the ground crossed, crossed position is consistent with the battery mold rack base dimensions.

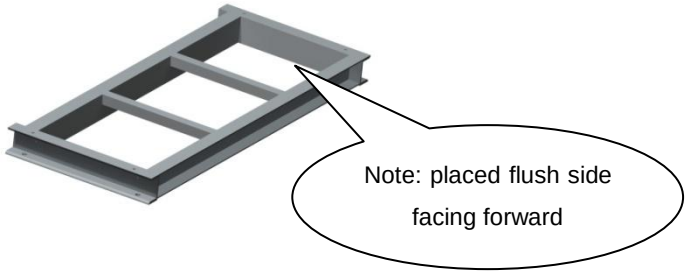
3.3.3 Placing the base into the crossed position and adjust correct, well-marked (diagonal fixed) on foot hole position, and then remove the base.

3.3.4 Impact drill with drill on marks position, and put expansion bolt.



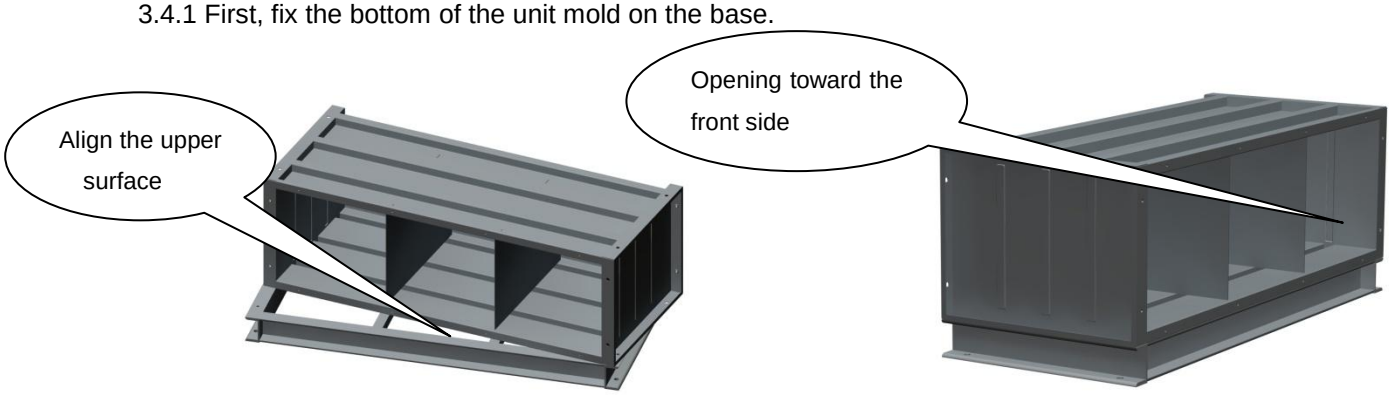


3.3.5 After cleaning up ground again, reset the base and its fixed. Front and rear direction of the base as shown below, and pay attention to the middle of the base support beams are flush with the upper surface

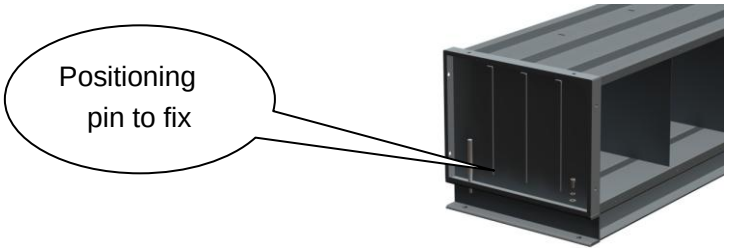


3.4 Battery mold rack assembly:

3.4.1 First, fix the bottom of the unit mold on the base.

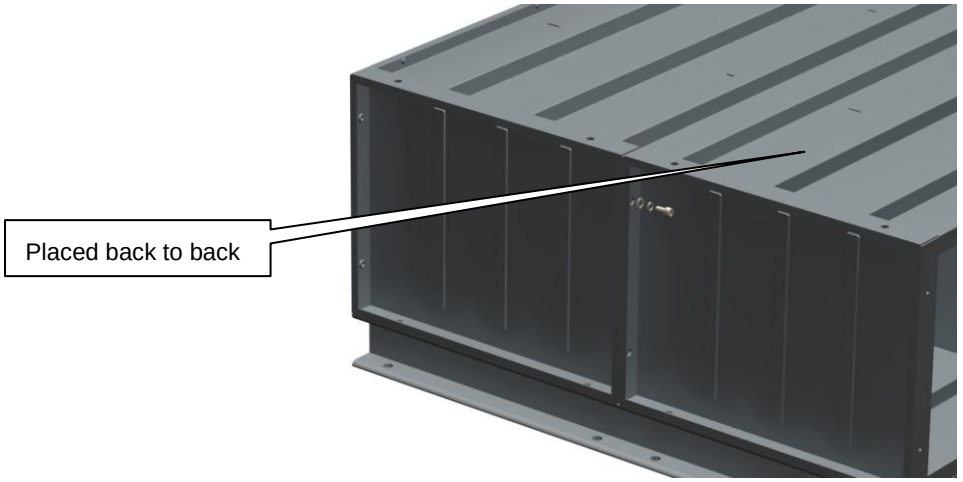


3.4.2 Using the positioning pins to fix position when installation. Use two locating pins calibration two pairs of diagonally arranged holes in 4 holes. After adjusting the relative position of unit mold and base, putting the bolts into the other two holes to both fixed. Then out of the positioning pin, and insert the bolt fixed.



3.4.3 Followed by installation of several units above mold, the installation method is the same with and unit mold and the base

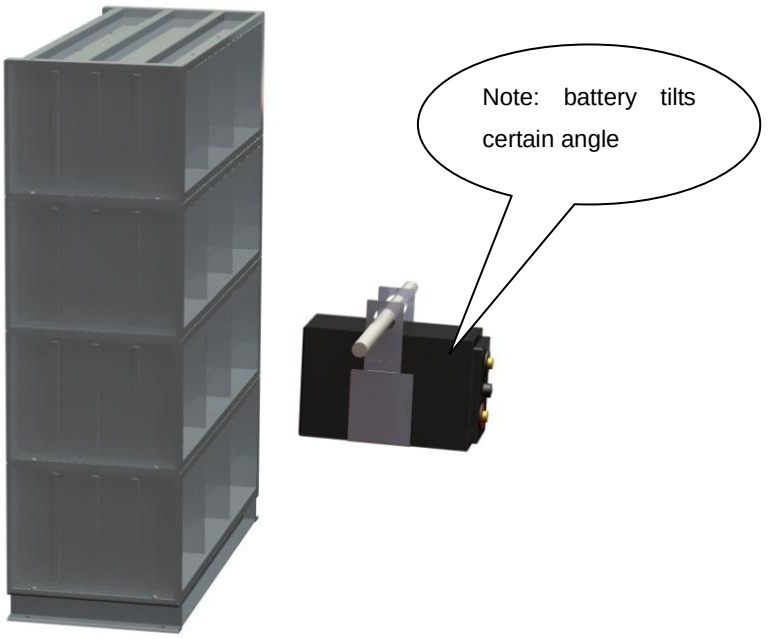
3.4.4 When using back to back installation, the back to back mold also needs to be fixed together by bolts.



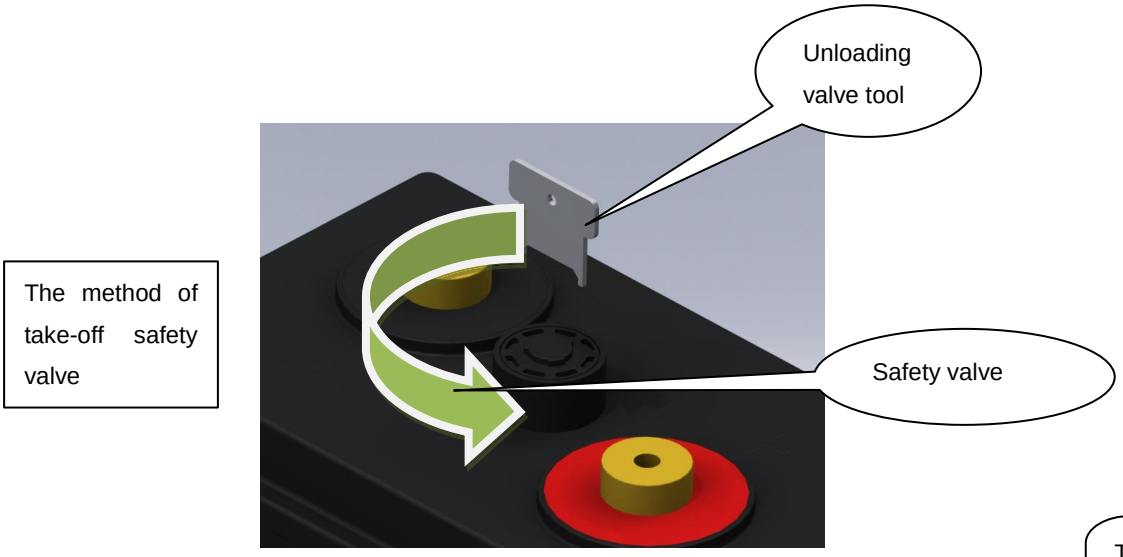
3.5 Battery installation

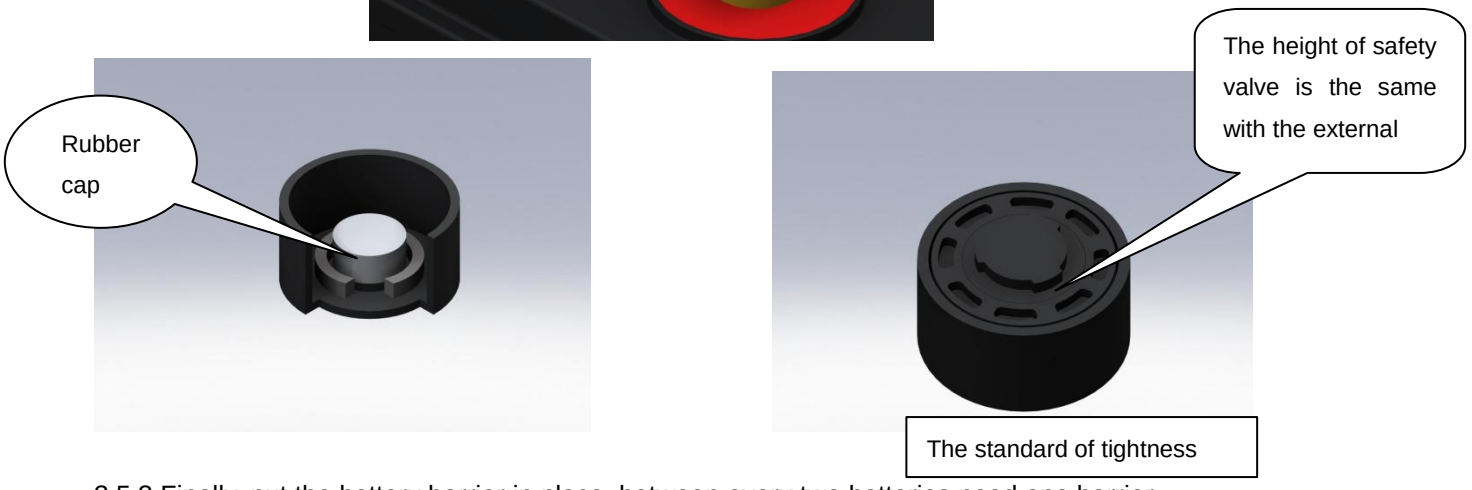
3.5.1 Refer to “Battery connection drawing”, put the batteries into the unit mold, and note the battery polarity.

3.5.2 1000Ah battery need to use auxiliary lifting board installation, pay attention to the battery tilt angle when the lifting, as the below figure show.

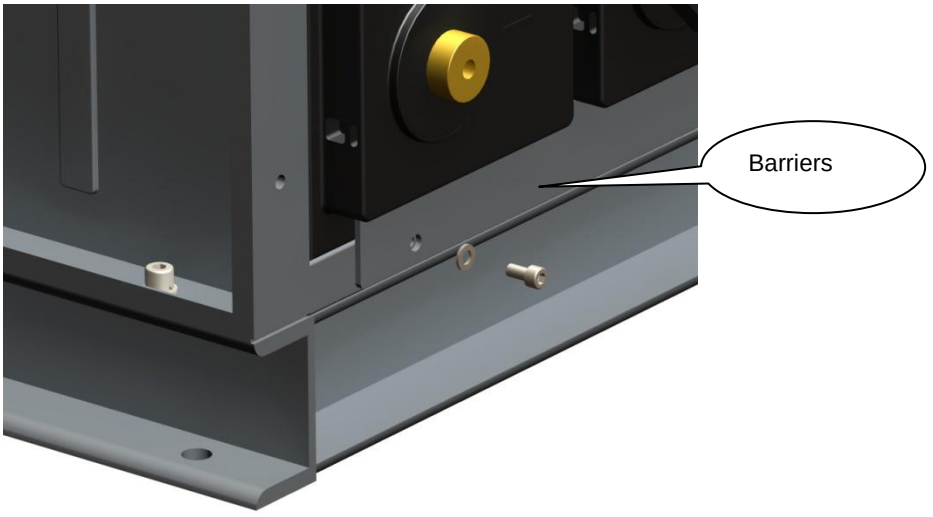


3.5.2 Install the battery in place. If there are difficult to install, you can use the unloading valve toll to loosen the safety valve to release the internal gas, until the battery in place to promptly re-tighten the valve





3.5.3 Finally, put the battery barrier in place, between every two batteries need one barrier.

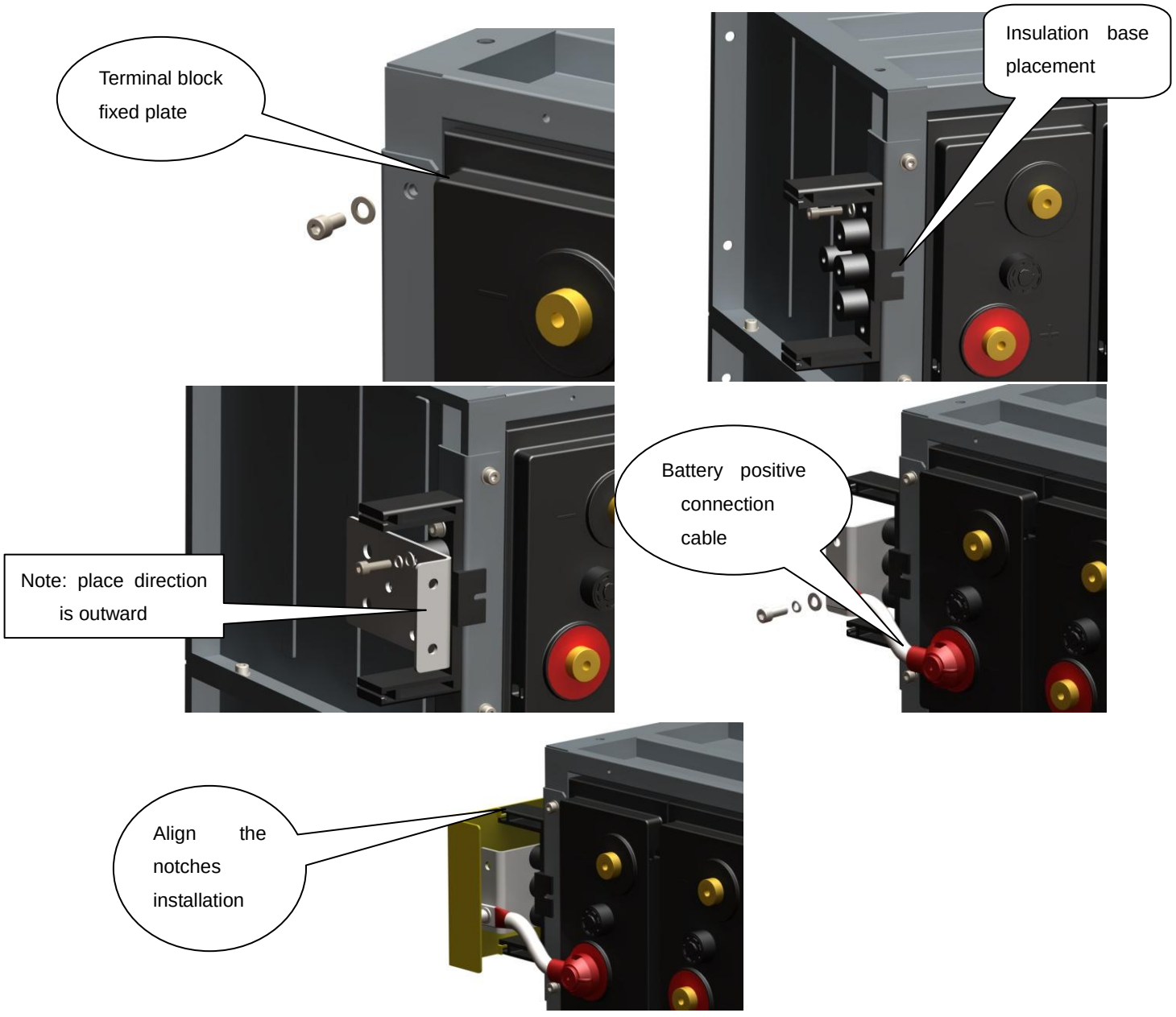


3.6 Terminal Block and the positive and negative cable installation:

3.6.1 Firstly need to install the terminal fixing plate to the battery pack's positive and negative leads to location, installation firm and correct.

3.6.2. Then install the black insulating base to the fixed plate, need the 5 # Ball hexagonal wrench through copper wiring rotating seat to fix the reserved bolts when installing.

3.6.3 After connected the positive and negative cable, and then put the protection cover at the location.

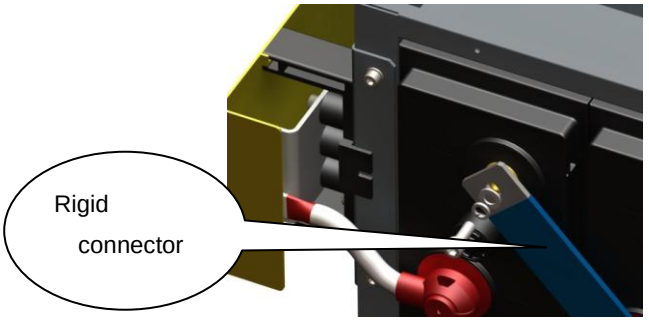


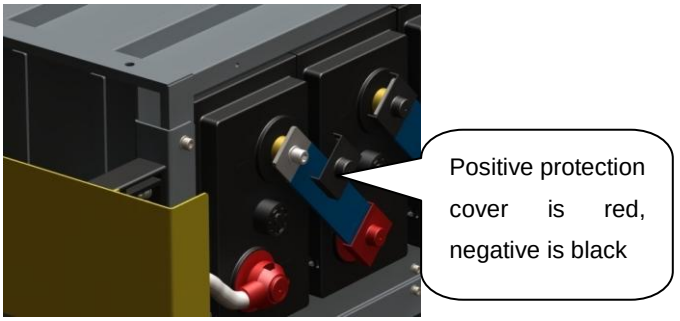
3.7 Battery connection

3.7.1 Refer to “Battery connection drawing”, installation battery connection accessories and bolts, the torque is less than 17.5N.m

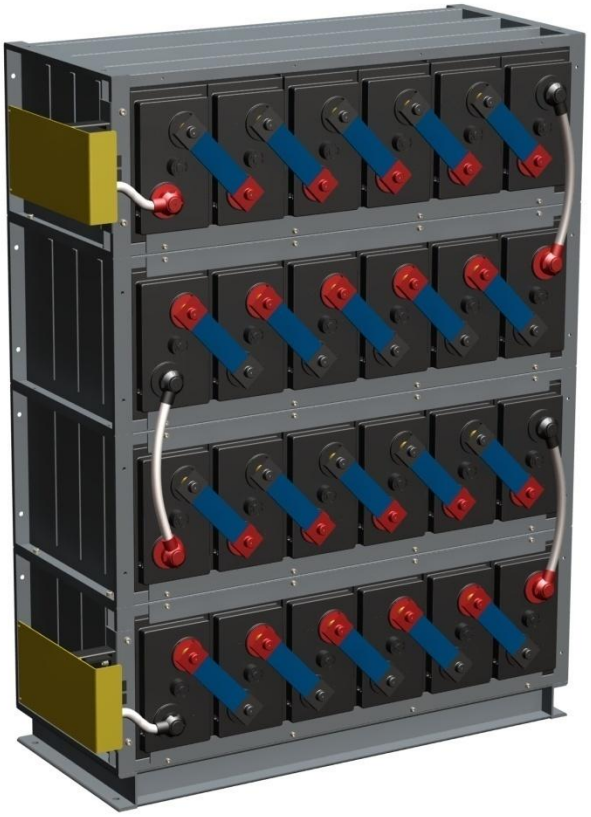
3.7.2 After connected the battery connection accessories, carefully check the bolts if there is loosening. Note the spring flat must be flattened.

3.7.3 After installed the rigid connectors, install the rigid connector protection cover. There are two kind of rigid connector cover, note do not bump and scratch.





3.7.4 The finished connected battery mold drawing as below.



Storage batteries differ from general household products, in that the batteries themselves maintain energy, while also exchanging energy duringthe discharge and charge stages. Because of these traits, this is a product that can cause serious dangers if handled incorrectly.

Storage batteries will deteriorate and reach the end of their service lives depending upon the years of use or the number of times of charge and discharge, and thus should be replaced before reaching the end of such lifespans.

1. Safety Cautions

For the safe use of storage batteries, it is essential to handle the batteries correctly and practice correct maintenance and inspection procedures.

This instruction manual divides the items that, if not properly followed pose dangers of accidents resulting in injury or death, into the three levels of Danger, Warning and Caution. Users are advised to closely read this manual to gain a solid understanding of the labeling.

Danger: This label indicates that mistaken use ignoring the label is likely to result in the danger of serious injury or even death to the user.

Warning: This label indicates that mistaken use ignoring the label poses the possibility of serious injury or even death to the user, as well as high potential for suffering minor injuries or material damage.

Caution: This label indicates that although mistaken use ignoring the label poses a low possibility of serious injury to the user, while there is the danger of suffering minor injuries or material damage.

The **“serious injuries”** mentioned above refers to vision loss, physical injury, burns, electric shock, broken bones, poisoning or other conditions in which complications remain, as well as conditions requiring hospitalization or extended outpatient care.

“Minor injuries” refers to burns, electric shock and other mishaps that fail to meet the definition of serious injury.

“Material damage” refers to expanded damage to residences and household belongings, as well as livestock, pets and other living creatures other than people.

Electric shock danger: This symbol alerts users of details requiring caution (including danger and warning). The specific contents of the caution are displayed inside the symbol (in the case of this example, “Electric Shock Danger”).

2. Matters Requiring Safety Cautions

2.1 Explosions, Fires from Hydrogen Gas

Because storage batteries generate hydrogen gas, fire, short circuits between the (+) and (–) terminals and other conditions can cause ignited explosions or fires.

- ✧ Rooms should be well ventilated to maintain hydrogen gas concentration at 0.8% or less.
- ✧ Vinyl tape or other insulation should be applied to torque wrenches, spanners and other metallic tools.
- ✧ Keep fires, cigarettes or other lit items away from the batteries at all times.
- ✧ Never disconnect the vent plug located on top of the storage battery.

Explosion Danger

Keep away from fire

2.2 Burns or Vision Loss from Sulfuric Acid

Danger

The electrolytes in storage batteries consist of diluted sulfuric acid. If the battery is damaged andthe electrolyte leaks out, do not touch it directly, and use soda or another neutralizer to neutralize the solution. Allowing the solution to get in the eyes or on the skin or clothing can result in loss of vision, burns or other injuries. If the electrolyte does get on something in this way, immediately wash it off with large amounts of water. In particular, if the solution gets into the eyes or is mistakenly consumed, immediately arrange for an examination by a physician.

2.3 Electric Shock from Touching Electric Conduction Portion

Danger

When conducting maintenance inspections, always wear rubber gloves, rubber shoes and other protective gear. Allowing any part of the body to come into direct contact with the conduction part (charging component) will result in electric shock.

Electric Shock Danger

2.4 Static Electricity Explosions

- ✧ Always clean storage batteries with a damp cloth (a well-wrung rag, etc.). Because storage battery containers and lids are made from synthetic resin, cleaning with a dry cloth or duster can generate static electricity and cause ignited explosions.
- ✧ Never cover a storage battery with a vinyl sheet or other material capable of generating static electricity. There is a threat that such items will generate static electricity and cause ignited explosions.

Explosion Danger

3. Use Environment and Use Conditions

For the environment and conditions under which storage batteries are used, exercise caution on the following points.

- ✧ The surrounding vicinity temperature sphere under which this storage battery may be used is from –0 to +45℃. Using the battery in temperatures other than those in this range will accelerate degradation, cause freezing, abnormal heating and other conditions that can result in breakage, deformation or other problems
- ✧ To maintain the storage battery in optimum conditions, use the battery in the range of 5 to 35℃ whenever possible.
- ✧ Do not use the storage battery in locations with direct exposure to sunlight. Such exposure can cause degradation in the battery's components.
- ✧ Do not use the storage battery in the vicinity of heat generating parts. Heat may cause breakage in the battery or reduce its service life.
- ✧ Do not allow the storage battery to become wet (either fresh or salt). Water may cause damage or fire in the battery, and can also result in corrosion in the terminals, connecting plates or connecting wires.
- ✧ Do not use the storage battery in locations with large amounts of dust. Dust may cause the battery to short circuit.
- ✧ Do not place the storage battery in a location where it may be become immersed in water. Immersion in water may cause electric shock or fire.

Keep Away from

High Temperature

Electric Shock Danger

Explosion Danger

4. Handling When Commencing Use

4.1 Opening the Package and Inspecting

When the storage battery is delivered, check for any abnormalities in the packaging. Next, carefully open the box near where the storage battery will be installed, taking care to avoid any bumping or other impact on the battery.

- ✧ Carefully open the package, to avoid any bumping or other impact on the storage battery. Such impact can cause battery breakage.
- ✧ After opening the package, alert the manufacturer of any container breakage, electrolyte leakage or other possible abnormalities. Using the battery in such conditions can cause electrolyte leakage, fire or breakage.
- ✧ Never lift up the storage battery by the terminals to carry it. Such actions can cause breakage in the battery.
- ✧ When moving the storage battery, do not bump, drop or expose it to any other strong impact. Such impact can cause breakage in the battery.
- ✧ Because the control valve is incorporated under the vent plug, this plug should never be removed.

（1） This storage battery is a valve-regulated type model, eliminating any need for electrolyte level checks or replenishment.

（2） After opening the package, confirm the volume and visual appearance of the storage battery and

attachments.

4.2 Installation and Connecting

Combustion Danger

- ✧ Install batteries with the correct polarity (＋ , －). Installing batteries with the polarity reversed can result in fire or damage to the batteries or chargers.
- ✧ Do not tighten the bolts and nuts to any torque other than the stipulated values. Tightening to other torque can cause damage to the terminals through sparking or deformation.

(1) Installation (In case that the batteries have already been installed into the unit)

① Installing the channel bases

- Temporarily secure the channel bases to the floor by using the chemical anchor bolts (provided with the product) according to the attached working drawing.
- Level all the channel bases within ±1 mm by using the leveling plate.
- Adjust the span of the unit battery mounting holes.
- Tighten the anchor bolts to the torque specified in the table below.

Table 1: Chemical anchor bolt tightening torque

Nominal diameter	Specified torque N·m (kgf·cm)
M12	42.1 N·m (430 kgf·cm)
M16	107.8 N·m (1,100 kgf·cm)

Note: These values are the specified torques after hardening.

- ✧ When using any anchor bolts other than the anchor bolts provided with the product, tighten them to the torque specified in the instruction manual for the anchor bolts.

② Installing the batteries on the first stage

Explosion Danger

- ✧ Use torque wrenches, spanners and other metal tools insulated with vinyl tape or the like. The use of non-insulated tools can result in a short circuit leading to burn injuries and the explosion of batteries or other damage to batteries.
- ✧ Do not topple or strike single batteries and unit batteries. The batteries can break or cause injury.

- Mount the M12 eyebolt nuts to the channel at the upper edge of a unit battery and lift the battery with a lifter or the like to put the battery on its side. (See Figure 1.)

Figure 1

- Connect fabric belts to the M12 eyebolt nuts at four points in the channels of the unit battery placed on its side. Lift the unit battery with a lifter or the like using the belts connected at the four points. (See Figure 2.)

Figure 2

- See the working drawing or the layout drawing to confirm the polarity and slowly lower the unit battery while aligning the unit battery mounting holes with the channel base mounting holes
- Adjust the unit battery in the proper position. Insert the unit battery fixing bolts (M12×35 with two plain washers) from below the channel bases through the unit battery mounting holes, and temporarily secure the bolts using the nuts (with two plain washers). (See Figure 3.)

Figure 3

③ Installing the batteries on the second and higher stages

- Install the unit battery on the second stage in the same way as on the first stage. Temporarily secure the upper and lower unit batteries together using the bolts and nuts with two washers.
- Check again that the batteries have been placed with the correct polarity and tighten the unit battery fixing bolts (M12) to a torque of 107.8±1 N·m (1100±10 kgf·cm).
- After installing the battery on the second stage, install the unit batteries on the third and higher stages in the same way.
- After installing all unit batteries, check again that they have been placed with the correct polarity.

④ Connection of connecting plate

✧ Install batteries with the correct polarity (＋,－). Installing batteries with the polarity reversed can result in fire or damage to the batteries or chargers.

✧ Do not tighten the bolts and nuts to any torque other than the stipulated values. Tightening to other torque can cause damage to the terminals through sparking or deformation.

✧ Avoid using a wire brush or other hard tools to polish the battery terminal and connecting plate surfaces. Otherwise the lead plating can peel off, resulting in corrosion.

✧ Lightly apply the enclosed lead acid battery use anticorrosion agent (white vaseline, etc.) over the entire battery terminal area, and then attach the connecting conductor with a bolt and nut. After attaching, lightly apply the enclosed lead acid battery use anticorrosion agent to the area around where the bolt and nut and connecting conductor are fastened. Failure to apply the anticorrosion agent can result in the generation of a high-resistance corrosion layer.

- Polish surfaces of all battery terminals (surfaces in contact with the connecting plate) using a brass brush or the like.
- Polish the conductive connecting surfaces of the connecting plates (the interfaces between the terminals and the connecting plates) using a brass brush or the like.
- Apply a thin coat of the lead acid battery anticorrosion agent (provided with the product) on the polished conductive contact surfaces of the connecting plates and battery terminals.
- Sequentially connect the connecting plates by using M10 bolts (with a flat washer and a spring washer) according to the working drawing.
- Tighten all the connecting bolts to 17.2±2.5 N·m (175±25 kgf·cm).
- Finally, check that all the bolts have been tightened and apply a thin coat of the lead acid battery anticorrosion agent (provided with the product) around the tightened parts of the bolts, nuts and connecting conductors.

✧ Do not allow coated wire or sheets containing soft vinyl chloride or other plastic to touch the container or lid. In addition, benzene, thinner, gasoline or other organic solvents or detergents should also not be allowed to come into contact with the container or lid. Such contact can result in container or lid breaking or cracks, becoming the cause of electrolyte leakage.

Electric Shock Danger

⑤ Installing the connecting plate covers

- Install the intermediate connecting plate covers, the inter-row connecting plate covers and the terminal connecting plate covers from the front side.

(2) Installation (In case that the batteries are installed into the unit on the site)

① Installing the channel bases

- Carry out in the same way as described in the work of the Section 4.2 ,(1) , ① ("Installing the channel base").

② Installing the unit on the first stage

- Slowly lower the unit while aligning the unit mounting holes with the channel base mounting holes.
- Adjust the unit in the proper position. Insert the unit fixing bolts (M12×35 with two plain washers) from below the channel bases through the unit mounting holes, and temporarily secure the bolts using the nuts (with two plain washers). (See Figure 3.)

③ Installing the units on the second and higher stages

- Install the unit on the second stage in the same way as on the first stage. Temporarily secure the upper and lower unit together using the bolts and nuts with two washers.
- Tighten the unit fixing bolts (M12) to a torque of 107.8±1 N·m(1100±10 kgf·cm).
- After installing the unit on the second stage, install the unit on the third and higher stages in the same way.

④ Inserting the batteries

✧ Do not topple or strike single batteries. The batteries can break or cause injury

✧ Insert batteries with the correct polarity (＋,－). Inserting batteries with the polarity reversed can result in fire or damage to the batteries or chargers.

- Insert the batteries in order from the first stage of the unit.
- Insert the batteries slowly. Do not give a shock to the batteries.
- Insert the batteries slowly, and do not strike the cover of the battery by the bottom plate of the unit.
- If there is a risk of striking the cover of the battery, insert the batteries while laying synthetic resin plate of about 1mm thick in the gap between the unit and the battery bottom. Be careful the top of the cover of the battery so that it does not clash with the unit when the battery is inserted. Remove synthetic resin plate then. (See Figure 4.)
- Insert batteries with the correct polarity (＋,－).
- Do not strike the terminals of the battery when the battery is inserted.
- After inserting the batteries, put the retainer plate to hold the batteries.

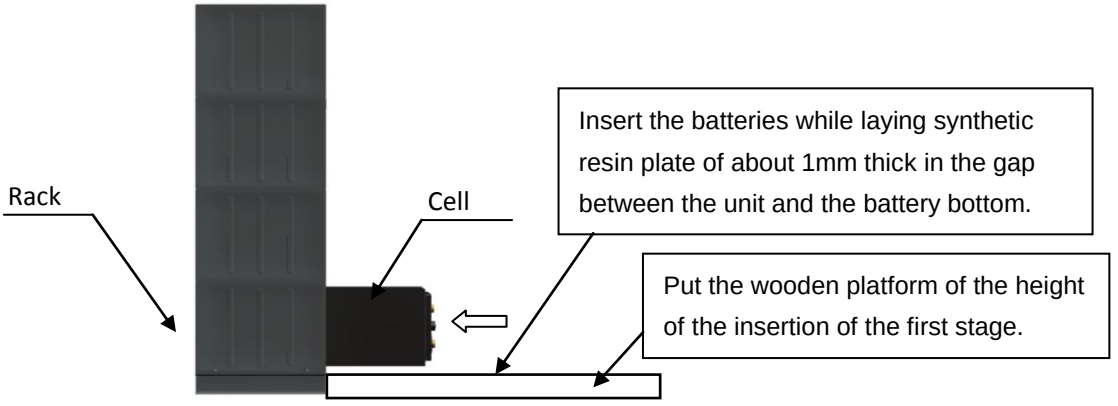


Figure 4

⑤ Connection of connecting plate

- Carry out in the same way as described in the work of the Section 4.2 , (1) , ④ (" Connection of connecting plate ").

⑥ Installing the connecting plate covers

- Carry out in the same way as described in the work of the Section 4.2 , (1) , ⑤(" Installing the connecting plate covers ").

4.3 Auxiliary Charge

Storage batteries will lose partial capacity as a result of self-discharge during transport or storage. Because of this, auxiliary charge should be performed along the following guidelines.

(1) Perform auxiliary charges for about 5 hours per cell at 2.45V constant voltage (initial charge current of 0.1CA or below).

Auxiliary Charge Time Requirement Guideline

Temperature(℃)	25 or less	30 or less	35 or less	40 or less
Period (months)	6 or less	4 or less	3 or less	2 or less

- ✧ Auxiliary charges should be performed by the manufacturer-stipulated methods, using the manufacturer-specified charger or the chargerinstalled in the equipment. Use without auxiliary charge can result infailure to satisfy the load.
- ✧ Storage battery surface temperature should not exceed 45℃. Exceeding that temperature level can result in battery damage or degradation. When there is a danger of exceeding 45℃, either lower the charge current or temporarily suspend the charge to halt the rise in the storage battery temperature.

Keep Away from High Temperature

Note: After auxiliary charging, there may be instances when the terminal voltage of each cell (each storage battery) exceeds the maintenance standard sphere. This is caused by the gas absorption reaction at the negative plate, a distinguishing factor of the FCP type lead acid batteries, and observations should be made of the trends through the time of the six-month inspection.

4.4 Trial Operation

Storage battery performance tests or coupling tests of the storage battery and load or charger, etc., should be conducted in accordance with Section 5.1 (“Everyday Maintenance and Handling Cautions”).

Before commencing and after completing pilot tests, charge in accordance with Section 4.3 (“Auxiliary Charge”).

4.5 Pre-Use Preparations

Following the “Auxiliary Charge” in Section 4.3 and the “Pilot Operation” in Section 4.4, with the exception of instances in which actual use will follow immediately, as a general rule auxiliary charge should be performed in with the “Auxiliary Charge” in Section 4.3.

When using a storage battery, always discharge the hydrogen gas and release the heat.

Danger: Because storage batteries generate hydrogen gas, ignited explosions or fires can be caused by sparking or short-circuiting.

Ventilate the room interior to maintain hydrogen concentration at 0.8% or below.

5. Regular Maintenance and Handling

5.1 Regular Maintenance and Handling Cautions

- ✧ When conducting maintenance inspections, always wear rubber gloves, rubber shoes and other protective gear. Allowing any part of the body to directly touch the conduction part (charge component) will result in electric shock.
- ✧ Because the electrolytes in storage batteries consist of diluted sulfuric acid, if the solution gets in the eyes or on the skin or clothing, immediately wash it off with large amounts of water. In particular, if the solution gets into the eyes or is mistakenly consumed, immediately arrange for examination by a physician. Such instances can result in burns, loss of vision or other injuries.
- ✧ Always clean storage batteries with a damp cloth. Cleaning with a dry cloth or duster can generate static electricity and cause ignited explosions.

Electric Shock Danger

Wear Safety Glassed

Electrolyte Leakage Danger

Explosion Danger

- ✧ Never clean storage batteries with benzene, thinner, gasoline or other organic solvents or detergents. This can result in container or lid breakage or cracking, becoming the cause of electrolyte leakage.
- ✧ FCP type stationary lead acid batteries incorporate the control valve under the vent plug. Neither the vent plug nor the control valve should ever be removed, because this can result in performance degradation, shortened service life, damage and other problems in the storage battery.
- ✧ The work of moving or changing the installation location of storage batteries should be consigned to the manufacturer or be performed under the guidance of skilled personnel (experts). Having this work performed by unskilled workers can result in damage to the batteries.

Allowing storage battery temperature to rise can shorten the service life, and in severe cases cause thermal runaway. This can result in damage to the battery. Therefore, especially when installing batteries in cubicles or other tight locations, the interior of the cubicle should be forcefully ventilated to prevent the temperature in the vicinity of the battery from rising, while a ventilation port should be installed to provide ample heat discharge equal to or above that of the conventional sealed type stationary lead acid battery (catalyzer plug type).

Correcting charge voltage in accordance with storage battery temperature is an effective means of curbing heat generation.

Periodic inspections should be performed of voltage, visual appearance and other factors, with the bolts and nuts also regularly tightened. Failure to perform regular inspections can cause damage to the storage battery or result in ignited explosions.

5.2 Discharge

- ✧ Discharge final voltage should be as shown in Table 3. Be sure that the storage battery terminal voltage does not fall below that level. Storage batteries must not be left in a stage of discharge, but should be charged immediately.
- ✧ Characteristically, lead-acid batteries exhibit reduced output capacity (Ah) for discharge of a larger current. Conversely, they exhibit greater output capacity (Ah) when discharge is made with a smaller current. Therefore, if the battery is discharged at a high current under the low SOC condition, there is a possibility that the batteries are over-discharged and the batteries life become short. Also, if the lower limit of SOC in operation is set to less than 30%, it is possible that the some batteries are over-discharged by the difference of battery performance during the long-term operation. We recommend to discharge the battery with the discharge current equivalent to or smaller than that shown in Figure 5 for each SOC.
- ✧ Example) The SOC is 100% when the battery is fully charged. After 10 hours of discharge with a discharge current of 0.1 C10A, the SOC is brought down to 0%.

Caution: Storage battery discharge current should be set in accordance with the maximum discharge current values indicated in Table 4. Failure to do this can result in battery damage.

Table 3: Discharge Current Size and Discharge Final Voltage

Discharge Current (A)	Average Discharge Final Voltage Per Cell (V)
Under $0.1C_{10}$ or intermittent discharge	1.90
$0.1C_{10}$ or current close to this	1.80
$0.16C_{10}$ or current close to this	1.80
$0.23C_{10}$ or current close to this	1.80

Note: “C_{10}” expresses the 10-hour-rate capacity value.

Table 4: Maximum Current (A)

Charge	$0.2C_{10}$
Discharge	$0.4C_{10}$

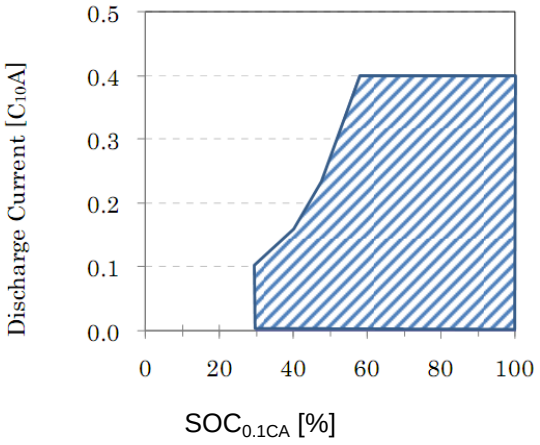


Fig. 5 The relationship between SOC and discharge current

(Recommended operation range)

5.3 Charge

(1)Equalizing charge

Partially charged batteries should be given an equalizing charge at least once a week. Use the following equalizing charge method.

- Multi-stage charge: Apply currents of $0.2C_{10}$A to the first stage, $0.1C_{10}$A to the second stage, 0.05C10A to the third stage and $0.02C_{10}$A to the fourth stage in this order. (switching voltage: 2.40 V/cell) After the terminal voltage reaches 2.45 V/cell at the fourth stage, charge the batteries for about 3 hours.
- Constant current/voltage charge: Apply a constant voltage of 2.45 V/cell (initial current of $0.1C_{10}$A or lower). After the voltage reaches, charge the batteries for about 5 hours.

(2) Recovery charge

Conduct recovery charges in accordance with the equalizing charge.

Caution: When the charge voltage deviates from the manufacturer-stipulated values, the following types of adverse effects will occur.

Remaining high for sustained periods (overcharge): Promotes electrolyte leakage and positive electrode grid corrosion, and shortens service life.

Remaining low for sustained periods (undercharge): Charge will become inadequate, promoting positive electrode grid corrosion and degradation of negative electrode active materials, and shortening service life. It will also become impossible to satisfy load, causing voltage disparity between cells.

When there are numerous instances of the temperature where a storage battery is installed exceeding the sphere of 5~35℃, it is recommended that corrections be made in the charge voltage setting value, using – 3.5mV/℃ cell temperature adjustment value with 25℃ as the starting point.

5.4 Cleaning

Clean and dry conditions should always be maintained for storage batteries and the surrounding area.

Caution

- Before cleaning, stand a distance away from the storage battery, and touch a metal part or take other action to remove the static electricity charge in your body.
- Always clean storage batteries with a damp cloth (a well-wrung rag, etc.). A dry cloth, synthetic cloth or other types of cloth will generate static electricity from friction, which can cause an explosion in storage batteries. Dusters and other cleaning implements will also generate static electricity in the same way, and have a danger of causing explosions in the batteries.

Explosion Danger

Electrolyte Leakage Danger

- Never clean with thinner, alcohol, gasoline, benzene, kerosene or other organic solvents, oils, detergents, chemical rags or similar implements. Such materials should never be used because they can cause container or lid breakage, electrolyte leakage, machinery corrosion and earth current, thereby causing combustion or the generation of smoke.Storage batteries and the areas around them should be inspected regularly, keeping them clean and in good order and removing unnecessary items and other obstructions to ensure proper ventilation and inspection. Checks should also be made for water leakage, wet floors and other undesirable conditions, with any problems corrected to maintain dry conditions. For regular inspections, cleaning and other measures should be taken in accordance with the contents of the regular inspection item list.

Combustion Danger

5.5 Periodic inspection

To prevent storage battery problems before than can occur, periodic inspections should be conducted within the suggested periods. Any deviation from standards should be dealt with through proper measures, with all measures taken recorded and stored.

Cautions:

- Storage batteries should be inspected on a periodic basis, following the periods stipulated in the Fire Defense Law and other regulations. When inspection results indicate deviations from standard range recorded in the instruction manual, proper measures should be taken on the basis of the instruction manual. All measures taken should be accurately recorded. Continued use in deviation of the standards can result in battery breakage, fire damage or performance degradation.

Combustion Danger

- Storage battery inspections should be performed by “certified storage battery equipment maintenance engineers” or other experts. Having such inspections performed exclusively by unskilled workers can result in errors.

Explosion Danger

- FCP type stationary lead acid batteries incorporate the control valve under the vent plug. Neither the vent plug nor the control valve should ever be removed, because this can result in performance degradation, shortened service life, damage and other problems in the storage battery.
- Before inspecting, stand a distance away from the storage battery, and touching a metal part or take other action to remove the static electricity charge in your body. Touching a storage battery with an electric charge in the body can cause sparks, and possibly trigger an explosion.

(1) One-Month Inspection

Item	Details	Standard	Measures
Total voltage during recovery charge or equalizing charge (❇1)	Check voltage indication value on panel surface voltmeter(❇2)	Equalizing charge voltage (2.45V/cell) × number of cells.	When deviating from standard, adjust by equalizingcharge voltage (2.45V/cell) × number of cells. (❇3)

Caution: Measuring equipment used to take these measurements should be calibrated on a regular basis, with use made only of items that fall within the allowable margin of error.

(❇1) When the charge method is unclear, please ask the maker of the storage battery system.

(❇2) When there is not the panel surface voltmeter, please ask the maker of the storage battery system a confirmation method of the voltage.

(❇3) When the adjustment method is unclear, please ask the maker of the storage battery system.

(2) Six-Month Inspection

Item	Details	Standard	Measures
① Total voltage during recovery charge or equalizing charge (❇4)	(1) Measure total voltage with voltmeter of 0.5-class or above. (2) Check voltage indication value on panel voltmeter. (❇5)	(1) Value of equalizing charge voltage (2.45V/cell) × number of cells. (2) Allowable margin for panel mounted gauges as stated in JIS C1102-2 (direct-acting indicator electric gauges).	(1) When voltage value deviates from standard, adjust by equalizing charge voltage(2.45V/cell) × number of cells. (2) Repair or replace gauges deviating over the allowable degree.
② Voltage of each cell duringrecovery charge or equalizing charge (❇4)	Measure open circuit voltage of each cell.	The voltage is measured from 2 to 24 hours after the recovery charge or equalizing charge was completed. The voltage of each cell must be 2.10V or more. The voltage of any cell must be within the following range: Average voltage ±0.05V	When the voltage value deviates from the standard value, observe for 1 to 2 months, and contact the manufacturing company.
③Visual appearance of storage battery, etc.	Check for presence of breaking or deformation damage in battery box, lid, etc., as well as electrolyte leakage.	Absence of cracking, deformation and other damage or electrolyte leakage.	In cases of damage or electrolyte leakage, investigate the cause, and replace the battery containing anydamaged items or found to have electrolyte leakage.
	Check for presence of dirt or stains from dust, etc.	Absence of dirt, stains or corrosion.	Clean any dirt or stains with a damp cloth.
	Check for evidence of rust	Absence of stains or	Clean, treat for rust

	formation in cubicles, battery box, platforms, connecting plates, connecting wires, terminals, etc.	corrosion.	prevention, coat or otherwise repair. When there is damage or electrolyte leakage in the battery, investigate the cause, and replace the batteries on which any items are damaged.
④ Temperature in vicinity of storage battery	Measure temperature in vicinity of storage battery.	40℃ or below	When temperature is high and exceeds the standard value, investigate the cause and carry out cooling measures (temporarilyhalt charging, improveventilation, etc.).

Note: Periodically calibrate measuring instruments used for measurements to keep them within the allowable margin for error.

(❇4) When the charge method is unclear, please ask the maker of the storage battery system.

(❇5) Please ask the maker of the storage battery system a measure method of the total voltage. When there is not the panel surface voltmeter, please ask the maker of the storage battery system a confirmation method of the voltage.

(3) One-year inspection

For one-year inspections, perform the sequence of the six-month inspections plus the following item.

Item	Details	Standard	Measures
Connecting part	Further tighten the bolts and nuts.	There are no loose parts after tightening to the clamping torque shown below.	When loose, tighten to the torque shown below.
		17.2±2.5N·m (175±25kgf・cm)	

Note: Periodically calibrate measuring instruments used for measurements to keep them within the allowable margin for error.

6. Measures at Abnormalities

When abnormal conditions occur in a storage battery, adopt the proper measures based on the following cautions.

- When electrolyte leakage occurs in a storage battery, halt use and contact the manufacturer. Damage or electrolyte leakage in the equipment can be the cause of fires.
- When there is visible abnormal deformation (swelling) in a storage battery, halt use and contact the manufacturer. Storage battery breakage or electrolyte leakage can be the cause of smoking or combustion.
- When there is heating in a storage battery, halt use and contact the manufacturer.

Electrolyte Leakage Danger

Such heating can be the cause of storage battery breakage or fire damage.

- When there is breakage in a storage battery container or lid, halt use and contact the manufacturer. Such conditions can result in combustion or smoking caused by ignited explosion or electrolyte leakage.
- When electrolyte is spilled on the floor, use soda or another neutralizer to neutralize the solution, then wash the area with large amounts of water and thoroughly dry. Such spillage can cause corrosion in the floor, parts or machinery.
- Never use water to extinguish fires in storage batteries – instead using a powder type (ABC) fire extinguisher. Water can cause the fire to spread, becoming the cause of electric shocks.
- After earthquakes or other natural disaster or calamity, follow the one-year inspection measures in checking for container breakage, electrolyte leakage and other abnormal conditions. Continuing use in the presence of such abnormalities can cause electrolyte leakage or fires.
- When the temperature sensor activates, check for the presence of abnormalities in the storage battery and charge devices. If any such abnormalities are discovered, contact the manufacturer.
- Following earthquakes or other natural disaster or calamity, retighten all bolts and nuts to the stipulated torque values. Continuing use without such retightening can be the cause of sparking, terminal breakage or other problems.

Explosion Danger

Electric Shock Danger

7. Measures When Suspending Use

Because storage batteries will gradually lose their capacity even when not in use, auxiliary charge should be performed on a regular basis in keeping with the stipulations of Section 4.3 “Auxiliary Charge.”

Explosion Danger

Danger: Because combustible hydrogen gas will be produced by storage batteries even when suspending their use, all battery rooms, cubicles or storage areas should be well ventilated. The batteries should also never be allowed close to fire. Failure to follow these cautions can result in ignited explosions and/or fire.

Keep Away from Fire

Caution: When suspending use of a storage battery for an extended period of time, conduct auxiliary charging in accordance with the stipulations of Section 4.3 “Auxiliary Charge,” disconnect the battery from the charger and load, then (if possible) store in a location which is dry, cool and not exposed to direct sunlight. Failure to follow these steps can be the cause of storage battery degradation.

Keep Away from High Temperature

8.Other Points of Care When Handing

When handling a storage battery, always observe the following cautions. Failure to do so can result in storage battery electrolyte leakage, heating, ignited explosion, fire or smoking. Always follow these indications in the interest of maintaining safety.

Warning: Do not cause short-circuiting in the storage battery (+) and (-) terminals.

Explosion Danger

Caution:

- ✧ Never place a storage battery in fire or heat it up.
- ✧ Never disassemble or modify a storage battery.
- ✧ Never reverse the storage battery (+) and (-) terminals to charge, use, etc.
- ✧ Never combine different types or brands of storage batteries for use.
- ✧ Never strongly bump or throw a storage battery.

Combustion Danger

Caution: When painting a cubicle or platform or battery box, never allow the paint to get on a storage battery. Paint on a container, lid or other battery part can result in cracks, and become the cause of electrolyte leakage or breakage.

9. Measures for Product Dispose

Storage battery disposal should be handled with observance of the following cautions.

Warning:

- ✧ Disconnect the connecting conductors. Electric energy remaining in a storage battery can be the cause of fire or electric shock.
- ✧ Avoid causing sparks or short-circuiting. Electric energy remaining in a storage battery can be the cause of ignited explosions.

Electric Shock Danger

Caution: Spent storage batteries should be collected (recycled). Do not dispose of the batteries as-is.

Explosion Danger

10. Expected Cycle Life

Expected cycle life represents the service life of a battery used under defined conditions. Table 5 presents the expected cycle life used under an ambient temperature of 25°C, a discharge current of 0.23 C_{10}A × 2.3h (DOD 70% for the capacity of discharge of 0.23C_{10}A), and a charging voltage of 2.45 V to charge up to 104% of the discharge capacity. Expected cycle life is not a guaranteed value.

Table 5: Expected Cycle Life

Storage Battery Type	Expected Cycle Life (25℃)
FCP type	4200 cycles (DOD70%)

Warning: Continuing to use batteries after the time to replace them has passed can cause them to deform, leak electrolyte, break, generate heat, explode, ignite or generate smoke.

11.Troubleshooting

Condition	Causes	Measures
Wide gaps in storage battery voltage (diversion from manufacturer-stipulated values)	(a) Faulty equalizing chargevoltage setting. (b) Post-discharge charge not conducted properly. (c) Combination with abnormal storage battery. (d) Storage battery has reached end of service life.	(a) Correcting set voltage value. (b) Reinspect at fully charged conditions. When reinspection results show disparity with standard value, arrange for manufacturer inspection. (c) (d) Contact manufacturer for replacement.
Storage battery temperature abnormally high	(a) Equalizing charge voltage set high. (b) Surrounding temperature high, withfull-time use at high temperatures. (c) Combination with abnormal storage battery. (d) Storage battery has reached end of service life.	(a) Lower voltage setting to stipulated value, and observe results. If the temperature still remains high, arrange for manufacturer inspection. (For rectifier and storage batteries alike) (b) Improve ventilation and conduct other measures, and observe results. If the temperature still remains high, arrange for manufacturer inspection. (c) (d) Contact manufacturer for replacement.
Paint peeling, corrosion etc. in platforms, battery box or cubicles	(a) External damage. (b) Inferior surrounding environment	(a) Clean and repair. Paint and otherwise finish. (b) Improve the environment.
Electric shock when touching storage battery, platform, battery box or cubicle	a) Wetness in storage battery, platform, battery box or cubicle due to electrolyte leakage, condensation, rainwater leaks, etc.	(a) Wipe with damp cloth, and take measures to eliminate the cause.

12.Batery setting charging/discharging parameters

Parameter type	FCP-1000 Setting parameters	FCP-500 Setting parameters
Max. continuous charging current(A)	$0.2C_{10}$	$0.3\ C_{10}$
Floating charging voltage (V)	2.23V/cell	2.23V/cell
Daily charge voltage (V)	2.45V/cell	2.45V/cell
Equalizing charge voltage (V)	2.45V/cell	2.45V/cell
Recommended equalizing charge period	1~2 weekly	1~2 weekly
High Voltage Alarm (V)	2.45V/cell	2.45V/cell
Max continuous discharge current(A)	$0.4\ C_{10}$	$0.4\ C_{10}$
Discharge protection Voltage	1.80V/Cell	1.80V/Cell
Equalizing charge to Floating charge transition condition	12h after charge voltage reaches 2.45V/cell	12h after charge voltage reaches 2.45V/cell
Temperature compensation coefficient	-3.50 mV/℃/cell	-3.50 mV/℃/cell