Unicad

Ni-Cd battery

INSTRUCTION MANUAL

FOR

INSTALLATION AND MAINTENANCE

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Precautions

Observe the following precautions on handling the pocket type Nickel-Cadmium Alkaline storage battery.

1) Fire Precautions

The alkaline storage battery produces fairly little explosive gas (hydrogen gas and oxygen gas) in charging. Therefore the battery room must be well ventilated and any inflammables must be kept away from the battery.

2) Handling of Electrolyte

Always wear rubber gloves, safeguard glasses or other adequate protector before handling the electrolyte(potassium hydroxide solution : KOH). If any of the electrolyte is splashed on human body or on clothes, do not rub but wash out the alkaline with running sufficient fresh water.

It is important to contact a doctor if the electrolyte is splashed into the eyes(which should be washed with running sufficient fresh water first).

3) Precaution against short-circuit and electric shock

Particular care must be exercised at installation (especially when mounting the connecting parts), because tools or other metallic articles can easily short-circuit the terminals. Do not place any tools on the battery when working.

4) Other Precautions

Precautions on handling the storage battery that may affect performance or service life of storage battery are given elsewhere in this manual.

Chapter I

Basic Knowledge on Storage Battery

1-1 Introduction

The two most popular types of storage batteries are Lead Acid and Alkaline batteries.

This instruction manual covers maintenance and installation of the pocket type Nickel-cadmium Alkaline storage battery.

The alkaline storage battery provides easier handling and maintenance plus long-life performance, as compared with a lead acid battery.

This instruction manual has been prepared to help you become familiarized with construction and performance characteristics as well as proper maintenance procedures of battery.

Before using the battery, please read the instructions carefully.

1-2 Construction

Four types of the alkaline storage battery are available from us.

1) KLP : low discharge rate cell : for emergency lights, train signals, ships, emergency control power etc.
2) KMP : medium discharge rate cell : for emergency power, operating power of controller.
3) KHP : high discharge rate cell : for engine, starting gas turbine, control system in power plant etc.
4) KXP : ultra high discharge rate cell : for starting engine, inverter, AGV, field to be needed much load at short time etc.

(1) Unit cell

1) Plate assembly

Main component unit of an alkaline storage battery cell is the plate assembly consisting of a number of positive and negative plates.

The positive plates are filled with nickel oxide and the negative ones are filled with active material of cadmium.

Several pockets, each made of finely perforated steel strips and filled with active material, are mechanically put together to form a rectangular shape and then trimmed with steel frames to make a sheet-like plate.

Size in Capacity of Unit cell settles the number of plate and unit cell must be assembled in such a way that positive and negative plates alternate i.e., negative-

positive-negative and so on(the positive must always have one more plate than the negative when assembled). The plates so assembled as above are separated and assembled from each other by means of rod type, latticed type of separator.

2) Cell container

The plate assembly complex with terminal posts is housed in cell container made either of steel sheet or of plastic material. Generally, plastic containers are used for a small-sized cell and steel containers for a large-sized cell. The plastic containers take a good advantage of permitting observation of electrolyte level from outside. On the top side of cell containers have vent plugs through which electrolyte is added when required.

3) Electrolyte

Electrolyte for the nickel-cadmium alkaline storage battery is a solution of chemically pure potassium hydroxide mixed with a small quantity of powder lithium hydroxide in ion-exchange purified or distilled water.

4) Other parts

Most parts are made of nickel plated steel except a few others made of rubber or synthetic resin. Therefore, the entire structure gives a high mechanical strength.

(2) Unit Battery

Two or more unit cells are put together in a wooden or metallic box or tray to make a unit battery according to operating voltage requirement. The cells of a unit battery are connected in series with each other by means of connecting bars. The box or tray is usually provided with handles for carrying convenience. The number of cells to be included in a unit battery is determined on the basis of dimensions, weight of the component cell as well as voltage to be used.

1-3 Chemical Reaction during Charge & Discharge

Active material for the positive plate is mainly composed of nickel hydroxide, while that for the negative plate is mainly of either cadmium or cadmium hydroxide. The electrolyte is an aqueous solution of about 23% potassium hydroxide with some suitable additives.

The electrochemical reaction during charge and discharge is performed through oxidation and reduction of the active materials of the positive and negative plates.

CHARGE STATE	DISCHARGE STATE
2NiOOH + Cd + 2H2O	2Ni(OH)2 + Cd(OH)2

The electrolyte has very little to react directly with the charge and discharge except that it acts as an electrical conductor. For this reason, the specific gravity or

concentration of the electrolyte remains unaffected during the charge/discharge operation and therefore unchanged.

1-4 Characteristics

(1) Capacity

Capacity of battery is, roughly, quantity of electricity available from a fully charged battery when discharged at a constant current. Normally, it is indicated in CURRENT x HOUR(AH) and amounts to total Ah value of discharging at specified constant current (one-fifth of capacity) over duration of 5 hours (5-hour rate discharge). For example, It is normal for capacity of 100AH to last over 5hours in 20A. But in case of KXP(ultra high discharge rate cell)type, It is normal to last one hour.

(2) Voltage

Open terminal voltage of unit cell is between 1.3V and 1.5V, showing some variation within this range, depending on how long a particular cell has been left open-circulated after fully charged. Nominal discharge voltage is about 1.2V/cell in average for normal rate discharge. KLP type has a comparatively higher internal resistance, therefore more suitably used for low-rate discharge purpose. KMP type that has less internal resistance than KLP type is used for medium-rate discharging while KHP, KXP type finds its applications in high-rate discharge use.

(3) Relation between discharging rate and capacity

Capacity varies with discharging current as indicated by Table 1, discharging rate and capacity. As you may notice in the Table, capacity obtained by the normal rate discharge at 25℃ is taken as 100%.

Table 1. DISCHARGING RATE AND CAPACITY

TYPE	KLP		KMP		KHP		KXP	
Discharging Rate(C X AMP)	Capacity (%)	Final Volt (V/Cell)	Capacity (%)	Final Volt (V/Cell)	Capacity (%)	Final Volt (V/Cell)	Capacity (%)	Final Volt (V/Cell)
0.1	104	1.10	104	1.10	105	1.10		
0.125	102	1.00	102	1.06	103	1.10		
0.2	100	1.00	100	1.06	100	1.10		
0.33	97	1.00	100	1.06	97	1.10		
0.5	79	1.00	95	1.00	85	1.10		
1			72	1.00	90	1.00	100	1.00
2					83	1.00	93	1.00
3					76	0.85	85	1.00
5					62	0.85	62.5	1.00

☞ Note : The discharge rate and final voltage of each type

are shown below. (at 25℃)

CELL TYPE	DISCHARGE TIME (H)	FINAL VOLTAGE (V)
KXP	1	1.10
KHP	5	1.10
KMP	5	1.06
KLP	5	1.00

Chapter II

Installation of battery

2-1 Condition for Battery Room

The battery room that stores the battery must satisfy completely the following ambient conditions.

(1) partitioned from the machinery and tools that can affect batteries.
(2) Not exposed to the sun.
(3) Air-conditioned, or protected from an excessive high room temperature in a hot season(desirable room temperature : 25℃)
(4) Well ventilated(a forced ventilation may be required).
(5) Adequately sloped floor for drainage of cleaning water.

2-2 Unpacking and inspection

(1) Visually check the packing for damage or evidence of excessive shock.
Cautiously unpack to protect the battery from excessive shock.
(2) Check the unpacked articles for the following items:
Quantity : Quantity of delivered items.
Damage : Visually check deformation or damage of delivered articles.
If parts are missing or damaged, immediately contact transporter or central office, and take steps to procure missing or replacement parts.

CAUTION : ① Packages are clearly labeled with UP/DOWN mark. ② Do not turn the package upside down or up to side. ③ Avoid excessive vibration or shock to the contents.

2-3 Filling Cells with Electrolyte

Cells are delivered empty of electrolyte solutions, so that they should be filled with the electrolyte when put in service. Only those cells that are to be put in service very shortly will be filled with the electrolyte and then given the first charging as soon as possible after allowing enough time for the electrolyte to

permeate into the plate assemblies of each cell. More specifically, it takes four hours or so before the active materials in the plate assemblies become sufficiently moistened with the electrolyte and ready for the first charging, If all or some of the cells delivered are not to be put in service for some time, keep them properly in storage as instructed in Item 4-7.

(1) How to fill

Using electrolyte jug and funnel supplied as maintenance tools, fill each cell with a required amount of electrolyte.

For your safety, put on rubber gloves whenever you handle the electrolyte since it is irritating to human skins and causes alkali burns on the skin contaminated if left untreated, Pour in electrolyte carefully to avoid possible overflow or spilling,

- First Filling -

Remove the transport seal from the cell vents, fill the cells slowly to a level slightly above the low level mark. Check the cells after 30minutes and add electrolyte if the level has dropped, Two hours after the first charge has been completed, add electrolyte to the maximum level.

(2) How to adjust electrolyte level

1) For plastic cell container

See-through type. The plastic cell container permits one to see electrolyte level of each unit cell from outside. Slowly pour in the electrolyte until maximum level mark.

2-4 Installation of battery

(1) Installation of steel racks

Steel racks, on which the battery is to be mounted and arranged, come completely assembled for ready installation. Place each steel racks in level position, so that each component cell or unit battery may likewise be placed level. Otherwise, the battery's performance may be adversely affected.

Whether perfectly horizontal or not can be easily detected by checking electrolyte surface level against the level marks indicated on the plastic cell container.

Peace a piece or pieces of thin vinyl chloride sheet or similar material under the racks to hold the racks perfectly horizontal when such leveling is required.

(2) Arrangement of battery

Now, mount each component unit battery onto the rack(s). Carry each carefully by two persons or perhaps three, since it is now filled up with electrolyte and pretty heavy. Hold it as upright as you can when carrying. The batteries should be correctly arranged you can when carrying. The batteries should be correctly

arranged and set up on the rack(s) in accordance with the Wiring Diagram taking special care to avoid possible polarity confusion.

(3) Connections

Using appropriate connector bars supplied as accessories, connect component unit batteries in series to each other. Tighten each connection by means of appropriate pole nut spanner, supplied as an accessory. For safety, make the battery set open-circuited when connecting it to a battery charger.

Chapter III

First Charging and Storage

3-1 Pre-charge Preparation

Installed and connected properly as above, the battery should be fully charged as soon as possible. Before proceeding to charge it, however, check the A.C. power source and the battery charger to make sure they are in normal condition. Also measure voltage of the entire battery and each cell, specific gravity and temperature of electrolyte to make sure there is no irregularity. Now connect the (+) terminal of the battery to the (+) terminal of the battery charger and the (-) to the (-) for the charging.

3-2 Charging Procedures

The standard charging current fir each model of the batteries is shown in Table 2 below.

TABLE 2 CHARGING CURRENT

MODEL	CAPACITY (AH)	CHARGING CURRRENT (AMP) (CAPACITY x 0.2)	CHARGING TIME(Hr.)
KLP 100P	100	20 (100 x 0.2)	7~8
KMP 100P	100	20 (100 x 0.2)	7~8
KHP 100P	100	20 (100 x 0.2)	7~8
KXP 100P	100	20 (100 x 0.2)	7~8

(1)As indicated above, the charging should be continued for 7~8hours with the above- indicated constant current. (Refer to instruction manual for charger)

(2) Cell voltage gradually rises with progress of the charging, so that it is necessary to raise the rectifier's output voltage accordingly by means of its manual output voltage regulator in order to maintain the charging current

constant at the specified rate

(3) In the course of charging, the electrolyte temperature also rises, however slowly. If the temperature rises above 45℃, it is detrimental to the battery. In such a case, suspend charging temporarily and then resume it again after the temperature has dropped sufficiently.

(4) A recording form like one shown in TABLE 3 is a must when charging the battery. Record all particulars about the battery as the charging progresses.

TABLE 3　RECORDING FORM(EXAMPLE)

Model of Battery :	Date :
Charging Current :　　AMP	Name in Charge :
Battery No. :	

Time Elapsed	Total Voltage(V)	Voltage Per Cell(V)	S.G. of Electrolyte	Electrolyte Temp.	Room Temp.
Immediately Before					
Immediately After					
15Min					
30Min					
1Hr					
2Hr					
3Hr					
4Hr					
20Hr					

3-3 After-care of first charging

If the battery, after given the complete first charging, has discharged more of less less due to various tests involving load, it should be charged again with the 5-hour rate current for 7~8hours before put in actual service.

☞ Note : At the end of each charging, check each cell for proper electrolyte level. If found considerably lower than the max. electrolyte level mark, add distilled or ion-exchange purified water until the proper level is restored.

3-4 Storage of charged battery

If the battery that has become fully charged through the first charging is not put in service immediately, it should be handled as instructed in the following :
A charged storage battery is subject to a gradual loss in capacity due to self-discharge even when left unused. If the battery is to remain unused for a period of 6 months or more after fully charged, you should refer to Item 4-8 of this manual for its proper storage. If the battery is to be put back in service following less than 6 months of storage, it should be recharged fully every three months with the 10-hour rate current for 14 hours.

Chapter IV

Maintenance

4-1 Charging

A storage battery is charged with DC(Direct Current). For charging, be sure to to connect (-) pole of the battery to (-) terminal of the charger and (+) pole to the (+) terminal. For normal charging an alkaline storage battery is charged with 5-hour rate current for 7 hours. This equals to 140% of the nominal capacity. In other words, Ah efficiency of the alkaline storage battery is 71.5% of total amount of electric current put in for complete charging. That is why an alkaline storage battery is usually charged for 140% of the discharging it was subjected to.

Whether or not an alkaline storage battery has been completely charged cannot be judged by measuring the specific gravity of its electrolyte. The battery is deemed to have been fully charged when an additional 2.5 to 3 hours of charging was completed after the charging voltage had risen to constant 1.65-1.8V/cell during the charging.

(1) Floating Charge

When a battery is connected in parallel to both the rectifier and load for use as an auxiliary power source, it is kept charged with a small but constant current to automatically cover capacity loss resultant from self-discharge or other discharges imposed upon it during such use. This is called Floating Charge. When connected to a floating charge, the battery is kept in a fully charged state so that it may be readily used as auxiliary power source when a commercial power failure or voltage drop occurs.

Floating charge voltage is normally 1.40 to 1.50 V per cell and the ampere is about 1/40 of 5-hour rate current (1/200 C).

These values should be adjusted properly according to conditions under which the battery is in service; too much gassing or water consumption means the charging voltage is too high, whereas a gradual drop of capacity indicates he charging voltage is too low.

4-2 Influence of Temperature

Temperature is one of the factors affecting performance of a storage battery. Electrolyte temperature most suitable for charging is from 68°F(20℃) to 77°F(25℃). Usually, the temperature of electrolyte in cell gradually rises with

the progress of charging, but an excessively high temperature above 113°F(45℃) can affect the life of the battery, so please take care lest the temperature of the electrolyte should exceed the permissible limit during charge.
This battery is capable of withstanding an electrolyte temperature of 122°F(50℃), the highest temperature limit, for short periods of time and a sustained electrolyte temperature of up to 113°F(45℃) without damage or undue loss of capacity.

4-3 Topping up of electrolyte

The water electrolysis and evaporation constantly taking place in the cell, slightly lowers the electrolyte level in the cell. This is the reason why topping up of electrolyte is needed from time to time in order to keep the surface level between the Min. and Max. level marks or between the plate top and max. surface level.

(1) For Plastic Cell Container

Each cell has two level marks, Maximum and Minimum. A transparent container, it allows one to check the electrolyte level visually from outside with your own eyes. The electrolyte level should be kept between these Max. and Min. level marks. Top up with distilled or ion-exchange purified water when necessary. For decision of regular term to top up of electrolyte, It is possible to decide the correct time by checking how long cells be used. At the beginning of service, it is reasonable to top up of electrolyte one time for one month. Overcharge causes decrease of distilled water and results in increase of term and time for top up of electrolyte. To avoid it, good checking needed in operation.

4-4 Preparation of Electrolyte

The electrolyte for Alkaline Storage Battery is a solution of chemical pure potassium hydroxide (commonly know as caustic potash) mixed with powder lithium hydroxide dissolved in ion-exchange purified or distilled water. The electrolyte is furnished by us. It comes in a solid, dry tablet state and contained in a sealed vessel. Special attention should be paid to ensuring that only pure electrolyte is used. Otherwise, the cell may be injured permanently.
Dissolve the electrolyte little by little, maintaining the 1 to 4 ratio in weight between the electrolyte and the water. The properly prepared solution should have the 1.20/20℃ specific gravity.
Regulate the solution to the proper specific gravity, 1.20/20℃ by adding water or the electrolyte as appropriate.
Same electrolyte solution shows different specific gravity values at different temperatures: lower at higher temperature and higher at lower temperature. Specific gravity at 20℃ is taken as standard, from which it increases by 0.0005

per 1 drop form 20℃ and decreases also by 0.0005 per 1℃ rise above 20℃
While the standard specific gravity of the solution is set forth as 1.20℃/20℃,
the specific gravity ranging from 1.16 to 1.23 at 20℃ is allowable. Beyond 1.23,
the cell may be harmed and below 1.16, it will fail to act at the rated capacity.
For electrolyte handling, use a vessel of glass, porcelain steel, and anti alkaline
plastic, nickel. Never use that of copper, aluminum, celluloid or wood,
which will be the alkaline electrolyte.

☞ Note : The electrolyte readily absorbs carbon dioxide from the air, consequently

forming potassium carbonate, the presence of which in the electrolyte causes poor output of the cell. So keep the electrolyte in an airtight can to avoid the contamination caused by the absorption of carbon dioxide from the air.

4-5 Renewal of Electrolyte

The density of the electrolyte slowly decreases with a gradual low of alkali caused by gassing taking place in the cell or by accidental spilling of the solution. The electrolyte may also be contaminated with various impurities in the course of normal use. This makes it necessary to renew the electrolyte periodically.
On average service, a renewal once every five to six years will be enough, and in the course of this period the specific gravity will have fallen to the lowest limit.
The effects of impurities in the electrolyte deserve serious attention.
The presence of which in the electrolyte causes poor output of the cell.
The maximum permissible limit is 100 gms per litre.
Other acid radicals such as sulphate also have adverse effects on the positive plate.
The metal impurities more positive than copper would deposit on the negative plate and lead to a continuous self-discharge.
When the specific gravity of the electrolyte has fallen to the lowest permissible limit of impurities have accumulated in the electrolyte beyond a limit permitted, the electrolyte must be renewed immediately.
Before renewal of the electrolyte, the battery should be discharged to 0.6 - 0.8 volts per cell at 5-hour rate current (C/5).
After having discharged as above, open up the filler cap, insert a siphon into each cell through the filler tube and drain off the old electrolyte completely. Now, fill up each cell with the new electrolyte immediately, using a funnel and a jug (both supplied).
Do not allow the cell to remain empty of the electrolyte for too long nor rinse its interior with water.
For renewal of the electrolyte, usually use the Type B-20, which will be dissolved to provide 1.20±0.01 specific gravity.
Electrolyte, B-20 or A only, should be used for the renewal.

Please renew the electrolyte in the cell when :

1) the specific gravity of it has fallen below 1.16
2) the cell fails to work at the rated capacity
3) the impurities in the electrolyte have accumulated beyond the permissible limit or foreign materials (especially heavy metals).

The battery with its electrolyte renewed completely will restore the rated capacity when given the following charge and discharge treatment without being connected to the load. Before the charge and discharge, close the vent valve, clean each cell and make sure all cells are put in place, properly connected as they were before.

1) Charge the battery for 10 hours at 5-hour rate or 20 hours at 10-hour rate (200% charge for rated capacity)
2) Discharge the battery at 5-hour rate to 1.0 V/cell level.
3) Charge it again as 1) above and it will be ready for use.

☞ Note : Check all cells for proper electrolyte density and level after the charge.

4-6 Cleaning

The battery will provide better and longer service if kept clean.

Dirt and other foreign materials deposited on the battery will cause current leakage. The cell top is apt to be moistened with electrolyte. So, take care to keep it clean and dry since dirty and wet contacts will also cause leakage of current.

* Cautions in repairing

1) Clean the outside of the battery, especially cell top and pole assemblies at least once a month. Apply a sufficient quantity of anti-rust oil (Supplied by us) or Vaseline to the nickel plated parts.
2) Tighten poles and other connections now and then.
3) Avoid using solder and similar materials for repair or the battery.

4-7 Storage of Battery

To keep the battery in storage for a long period of time, namely, 6 months or more, it is, first of all, necessary to discharge it completely and remove the electrolyte also completely.

For such an extended period of battery storage, discharge the battery to OV and remove the electrolyte from all the cells and then close the vent plug of each cell. Be sure to store the battery in a room that is clean, cool, dark and dry. To put the battery back in service, fill every cell with the electrolyte properly as instructed previously and then charge it fully by following the same procedures for the first charging explained in Chapter III.

4-8 Regular Maintenance and Inspection

A battery gives optimum performance and longer life when given proper maintenance. Therefore, it is important to inspect it periodically and record its conditions by jotting down the results found at each inspection. Should something unusual be found, find out the cause therefore as soon as possible.

(1) Floating Charge Voltage

Floating charge is a way to supply load with electric power from battery in case of blackout or load fluctuating. For that case, battery must keep in good condition, be permitted appropriate floating charge voltage. Connect battery and load to charge device in parallel system and regular voltage must always be permitted for charge. Longevity and efficiency of battery depends on voltage figure to be set up in floating condition.

If the figure is lower than the one required, It results in shortage of charge and long period of this condition causes decrease of longevity on account of inactivation made by active material of the positive and the negative pole.

On the contrary, If the figure is higher than the one required, It results in over-charge and causes decrease of longevity as well due to deterioration of Isolated plates or corrosion of the positive and the negative pole.

Inner resistance makes the voltage difference between a type of battery and other types. The error range of battery voltage is ±5% settled by experiences of each manufacturer but it does not mean a permitted range for charger.

Refer to TABLE 4 to set up floating charge voltage.

(2) Equalizing Charge

Equalizing charge is a way to prevent floating charge voltage from getting out of its figure to be set up that results from self-discharge.

That is why several batteries are used for long time as a group for equalizing charge. Normally, equalizing charge is required once every 6 months and it does not need to be strictly abided by.

The TABLE 4 below is normal voltage for it.

TYPE	FLOATING CHARGE VOLTAGE	EQUALIZING CHARGE VOLTAGE
KLP	1.45±0.01	1.60～1.70
KMP	1.43±0.01	1.55～1.65
KHP	1.42±0.01	1.55～1.65
KXP	1.39±0.01	1.52～1.57

The total charge voltage is settled by multiplying the number which constitutes normal battery voltage. After equalizing charge, surly being switchover to floating charge voltage automatically.
If it does not happen, it results in overcharge and causes decrease of longevity and capacity due to evaporation of electrolyte.
Therefore certain checking is required for the switchover.

(3) Checking method

1) Checking points every one month

ITEM	CONTENTS	STANDARD	METHOD TO SOLVE
1.Total voltage of battery in floating charge	Check the instruction of the voltage figure on the panel of a voltmeter	Charge voltage × Number of battery indicated in TABLE 4	adjust in case of getting out of the standard voltage indicated in TABLE 4
2. Electrolyte level	Check electrolyte level if it is placed within the standard required or not	Surly placed within the range of minimum and maximum level	Check the leakage of electrolyte and fill up electrolyte to the maximum level if necessary
3. Appearance of battery	Check the leakage of electrolyte		Clean according to Item 4 - 6. If the leakage of electrolyte does not stop, contact us

2) Checking points every six month

ITEM	CONTENTS	STANDARD	METHOD TO SOLVE
1. Total voltage of battery in floating charge	1) Measure total voltage of battery with a voltmeter 2) Check the instruction of the voltage figure on the panel	1) Total voltage of battery is Floating charge voltage X number of cell shown in TABLE 4	1) Adjust in case of measured voltage's getting out of the standard voltage 2) Repair or replace battery which exceeds the permitted error
2. Voltage of each cell in floating charge	Measure the voltage of cell with a voltmeter	Surly place voltage of every cell within the range of ±5% shown in TABLE 4	If measured voltage is lower than the standard voltage, do equalizing charge shown in TABLE 4 and compare the result with the standard voltage again. If the result differs from the standard voltage after equalizing charge, contact us
3. Electrolyte level	Check electrolyte level if it is placed within the standard required	Surly placed within the range of minimum and maximum level	If electrolyte level is placed around or below the minimum level, fill up electrolyte to the maximum level
4. Appearance of battery	Damage or leakage of electrolyte caused by transformation of crack on the lid, cover etc.		1) Contact us if crack, damage, transformation are found 2) Clean according to Item 4 - 6, if leakage of battery happens. Contact us if it lasts constantly long time
	Pollution & damage caused by dirt etc.		Clean polluted points with wet Cloth
	Rust on the cubicle, holder, connecting plate, connecting line and terminal		cleaning, coating and repairing needed
	Damage on the various kinds of stopper and packing		Contact us if any damage is found

3) Checking points every one year

Checking points every one year adds checking points every six month to the particulars below.

ITEM	CONTENTS	STANDARD	METHOD TO SOLVE
Specific gravity & temperature in Pilot Cell in floating charge	Measure electrolyte & temperature in Pilot Cell	1) Specific gravity must be within the range we indicate 2) Temperature must be below 25℃ as much as possible	1) Adjust specific gravity within the range indicated 2) Set 20℃ as the standard of specific gravity and measure with a hydrometer and convert with the following formula $S20 = St + 0.0005(t - 20)$ S20 : Specific gravity converted by 20℃ St : Specific gravity measured at t℃ t : Temperature of electrolyte(℃)

☞ (Notice : Pilot Cell is selected optionally as a standard among compounded cells)