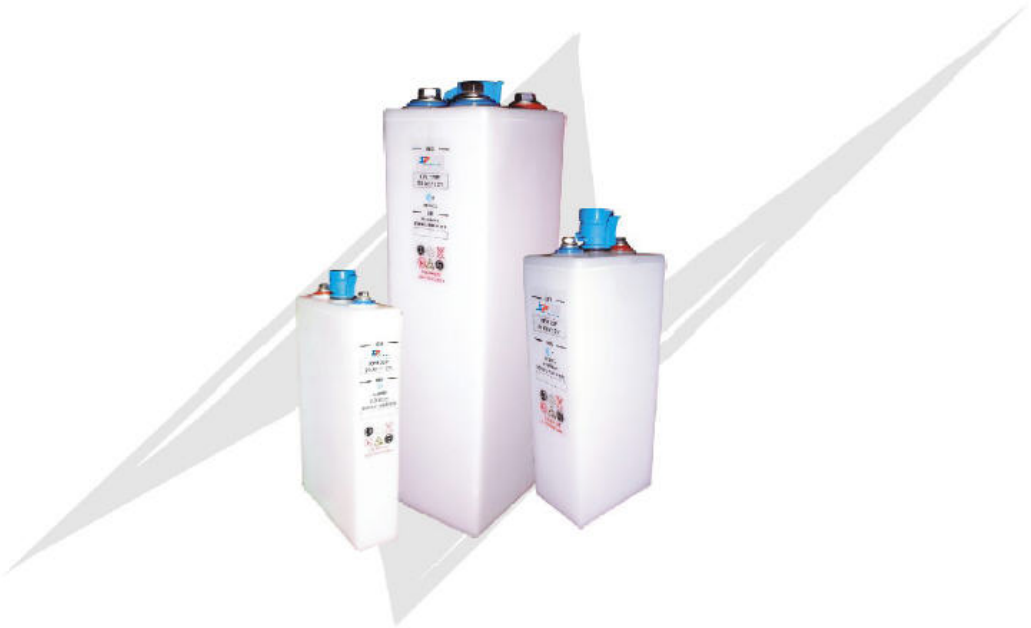
NCPP

Nickel Cadmium Pocket Plate Batteries



Installation and Operation Manual

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2.0 INTRODUCTION

We thank you for purchasing our reliable and long life nickel cadmium pocket plate battery. Please read and follow the instructions given in this manual to obtain the best performance and life from your battery. Inspect the battery at regular intervals and use the service log sheet provided at the end of the manual for maintaining the records. Contact Customer Service, for any additional help and guidance that you may require.

2.1 ELECTROCHEMISTRY

The basic principle of the rechargeable battery is the conversion of electrical energy into chemical energy and vice versa. The storage battery consists of a number of individual cells connected in series to produce the required voltage. Each cell consists of positive plates (containing nickel hydroxide as the active constituent) and negative plates (containing cadmium hydroxide) immersed in a solution of potassium hydroxide in DM/DI water with lithium hydroxide as an additive.

The simplified overall reversible electrochemical reaction given below produces a nominal discharge voltage of 1.2 volts per cell:

$$2\,Ni(OH)_2 + Cd(OH)_2 \underset{\text{Discharge}}{\overset{\text{Charge}}{\Leftrightarrow}} 2\,NiOOH + Cd + 2H_2O$$

When the cell is charged, the active materials initially present as hydroxides are changed. The cadmium hydroxide is reduced to cadmium and nickel hydroxide attains a higher degree of oxidation. On discharge, the process is reversed and the active materials revert to their original state.

The potassium hydroxide electrolyte doesn't take part in these reactions and acts only as a carrier of ions. The lithium hydroxide additive in the electrolyte significantly increases the life of the cell since it has a beneficial effect on the positive electrodes. This beneficial effect is more pronounced at higher operational temperatures.

2.2 CONSTRUCTION

The first and still the most reliable electrode design for nickel cadmium batteries is the pocket plate. The active material in each electrode is encapsulated in pockets of double perforated, nickel-plated steel strips. Several pockets are mechanically joined together and cut in suitable lengths to form plate pieces. U-section steel strips seal both cut edges of the plate pieces. The nickel-plated steel tab is joined to the plate piece and the U-section steel strips by spot welding. The plate assembly is compressed together to establish good contact between the active material, double perforated steel strips and U-section steel strips. The U-section steel strips and tab are the Current collectors of the plate.

Several plates of the same polarity are either bolted to the terminal post or welded to the terminal post. Negative and positive plate groups are interleaved so that plates of opposite polarities are alternated. Insulating each plate from the next by either a combination of insulating rods and edge insulation or grid insulation insulates the plate groups from one another. The plate block is firmly strapped together using a suitable number of polypropylene straps.

The cell container is of the either polypropylene or stainless steel. Matching cell lids are made of the same material as that of the cell container. Mirror welding is employed for thermally fusing the mating surfaces of polypropylene cell containers and lids, while TIG fusion welding is employed in case of stainless steel cell containers and lids. The choice of material depends on the application and operating conditions. The polypropylene containers are translucent and completely free from corrosion in wet and saline conditions. The assembly is compact and easy, and the polypropylene has high impact resistance.

Polypropylene cells are assembled on steel racks with step arrangement in order to permit visual electrolyte level maintenance checks. Alternatively, polypropylene cells are mounted in stainless steel crates, each holding a suitable number of cells to suit the space constrained battery boxes as in the case of mobile applications.

Steel cell are mounted in insulated wooden crates, each holding a suitable number of cells to suit the space constrained battery boxes as in the case of mobile applications. The wooden crates are also placed in steel racks (without the step arrangement) for stationary applications.

3.0 SAFETY PRECAUTIONS

3.1 ELECTROLYTE

The alkaline electrolyte (solution of potassium hydroxide in DM/DI water) is a strong caustic agent. Wear rubber gloves, eye protection and long sleeved clothing when working on the battery. Before working with electrolyte, make sure that water for washing is easily available. If electrolyte is splashed on the skin or clothing, wash immediately with water for 10 to 15 minutes. If eyes are affected, flood with water followed by eye wash solution and obtain immediate medical attention.

3.2 KEEP FLAMES AWAY

The battery will produce a mixture of oxygen and hydrogen gases during the last portion of high rate charging.

Do not adjust connections etc., while charging or in the first hour after charging.

Discharge any possible static electricity from clothes by touching earth-connected part.

Do not smoke in the battery room.

Keep the battery location well ventilated to prevent buildup of the oxygen and hydrogen gases, and do not cover the battery during charging.

3.3 TOOLS

Use tools with insulated handles / surfaces.

Do not place or drop metal objects on top of the battery.

Remove rings, wristwatch, loose coins from the pockets and articles of clothing with metal parts that might come in contact with the battery terminals.

4.0 RECEIVING THE SHIPMENT

4.1 UNPACKING AND INSPECTION

Do not over-turn the packages.

Unpack the batteries immediately upon the arrival and inspect for possible damage in shipment.

Make sure that small packages are not thrown out together with the packing material.

Check that all the material listed in the packing list has been received.

PLEASE INFORM STANDBY POWER IMMEDIATELY IN CASE OF ANY DAMAGE OR SHORTAGES IN THE CONSIGNMENT.

4.2 SHIPPING METHOD

THE BATTERY SHIPPED IN FILLED AND CHARGED CONDITION

Remove immediately the transport seal (red plastic film) from the vent cap. Remove the transit cap (blue/red), wherever mounted on cell terminals for big size cells.

Check the electrolyte level in the cells and add electrolyte if necessary.

The battery is then ready for installation or storing.

THE BATTERY MUST NEVER BE CHARGED WITH THE TRANSPORT SEAL IN PLACE AS THIS CAN CAUSE PERMANENT DAMAGE.

General Note for Storage of new / used battery in filled charged condition: Cover the battery with a sheet of plastic or similar protective cover to keep out water and shield against direct sunlight. Do not store other material on top of the battery.

5.0 STORAGE

5.1 STORAGE OF USED BATTERY IN FILLED & CHARGED CONDITION

If the battery is unused for a long period of time, but not more than one year, it should be removed from service and properly stored. Top up with DM/DI water to the maximum level mark and charge the battery to a fully charged state. Clean the battery thoroughly and coat the inter-cell and inter-crate connectors with anti-corrosion oil. Inter-crate connectors should be removed for cleaning, and then stored in a separate package. Store the battery in a clean dry, and cool location.

After removing from storage, the battery should be discharged to an average cell voltage of 1.0 volt at 0.2C Amps, and charge as per the instructions for first charging. However, **use only DM/DI water** for adjusting the electrolyte level after waiting for at least two hours after the first charging has been completed.

5.2 STORAGE OF USED BATTERY IN DRY & DISCHARGED CONDITION

If the storage period is to exceed one year, the batteries should be fully discharged at 0.2 C Amps to an end voltage of 0.6 volts per cell, and the electrolyte fully drained by Inverting the batteries for about 5 minutes. Use a plastic film to seal the flip top vent. Clean the battery thoroughly, then coat the inter cell and inter-crate connectors with anti-corrosion oil. Inter-crate connectors should be removed for cleaning and then stored in a separate package. Store the battery in a clean, dry, and cool location. Store the electrolyte in clean, airtight plastic containers for future use. After removing the battery from storage, follow the instructions for electrolyte filling, first charging and installing the battery. Cover the battery with a sheet of plastic or similar protective cover to keep out water and shield against direct sunlight. **Do not store other material on top of the battery.**

6.0 INSTALLATION

The battery should be installed in a clean and dry area.

The battery should never be placed direct on the floor where it is subject to dampness and dirt accumulation.

Batteries do not give off corrosive gas and therefore can be installed together with other electrical equipment.

To avoid accelerated ageing of the plastic due to ultra violet radiation, batteries using plastic cell containers and lids should not be exposed to direct sun light for long periods.

6.1 TEMPERATURE

Avoid placing the battery in a hot place or in front of a window.

The battery will give the best performance and maximum service life when working at a temperature between 10 and 30 degrees centigrade.

With adequate electrolyte specific gravity, the battery will perform properly within the temperature range – 40 to + 50 degrees centigrade.

Freezing will not cause damage to the battery.

6.2 VENTILATION

During the last part of high-rate charging, the battery gives off gas (oxygen-hydrogen mixture). At normal float-charge the gas evolution is very small. The ventilation requirement of the battery as per DIN 57510 can be expressed by the relation Q=55 x N x I, where Q is the quantity of air to be replaced from battery room in liters /hour. N is the number of cells in the battery, and I is the charging current at the end of high rate charging. Normally, no extra means of ventilation (exhaust fan etc.) is needed unless the battery room is extremely small in proportion to the size of the battery.

6.3 MOUNTING AND CONNECTIONS

Standby Power battery racks are recommended for proper installation.

These racks are made of steel components, which are protected with alkali-resistant paint. The step construction of the racks permit visual electrolyte level checks to be made on all cells and greatly facilitates the maintenance activity of topping up with demineralized water.

Battery racks are available in 2,3, or 4 steps in one or two tier configurations. Racks can be positioned alongside each other or back to back to suit the available space in the battery location. Ensure that the floor is level while positioning the racks.

All racks are supplied with insulators. However, the racks also have provision for direct bolting to the floor.

Assemble the racks with the help of the drawing, enclosed with this manual.

Position the cells on the rack suitably so as to permit connection of the positive and negative terminals according to the wiring diagram.

FOLLOW THE POLARITY TO AVOID SHORT CIRCUITING OF THE CELLS.

Connect the battery terminals to the equipment only after marking all the other inter-cell and inter-row connections

ONLY NICKEL PLATED COPPER CABLE LUGS SHOULD BE USED.

NEVER USE ALUMINUM CABLES AT THE BATTERY TERMINALS.

Use the correct torque to tighten the terminal bolts as indicated below:

BOLT DIAMETER	RECOMMENDED TORQUE
M 5	7.5 Nm (0.75 kgfm)
M 8	20 Nm (2.0 kgfm)
M 10	30 Nm (3.0 kgfm)

Ensure correct torque by using an appropriate torque wrench.

Improper torque will affect battery performance.

It is important that the battery is mounted firmly.

When there is a risk of crate movement as in the case of mobile applications, use wooden or plastic wedges for arresting the movement.

6.4 INSTALLATION OF BATTERY SHIPPED IN FILLED AND CHARGED CONDITION

The batteries supplied in Filled and charged condition (Shipping method 1) are ready for direct installation within three months.

In case of delay in commissioning for a period of more than three months from the date of dispatch, boost charge is recommended. The boost charging should be for such time till there is no change in consecutive readings of 15 minutes duration of cell voltages and which will be approximately 4-5 hours at a constant current of $0.2C_5$ rate.

7.0 ELECTROLYTE PREPARATION FOR FIRST FILLING

Please read and follow the safety precautions carefully while preparing the electrolyte.

The quantity of Electrolyte (if supplied in liquid form) per cell is given in the Technical Specifications.

The quantities of solid lithium hydroxide or solid potassium hydroxide required for each Battery, if supplied in dry & discharged condition are given in separate sheet. Use this data as proportions for preparing the electrolyte.

1000 cc Type B electrolyte contains the following quantities of potassium hydroxide, lithium hydroxide and DM/DI water.

Electrolyte Type	**Potassium Hydroxide (88-90%)**	**Lithium Hydroxide (55%)**	**Demineralised Water**	**Cell Type**
B-22, Density 1.20	268 gms.	40 gms.	890 cc	Standard
B-30, Density1.28	384 gms.	54 gms.	840 cc	For special Application(solar)

Type 'B' Electrolyte is a solution of lithium hydroxide crystals and potassium hydroxide flakes in DM/DI water. The number following the 'B' represents the quantity of lithium hydroxide in grams (assuming 100% assay) per liter of electrolyte.

The required quantity of D.M. Water is first taken into the container and appropriate quantity of lithium hydroxide crystals are added with constant stirring. When all the lithium hydroxide has dissolved, potassium hydroxide flakes are slowly added with constant stirring. The solution will become hot.

After cooling to room temperature, adjust the density as required within a tolerance of +/-0.01 by adding D.M. Water.

7.1 APPARATUS

Use only clean vessels of plastic or steel for preparing the electrolyte. Copper, Aluminum or Galvanized Vessels must not be used. Do not use accessories already used for lead acid batteries. Transfer the electrolyte into the cells using a clean plastic jug. The electrolyte must not be exposed to air for long periods. Ensure that the electrolyte does not get contaminated.

7.2 GUARANTEE CONDITIONS

Use electrolyte approved by Standby Power **ONLY**.

8.0 ELECTROLYTE FILLING

Flip open the top of the vent or unscrew the cap in case of screw type vent cap and remove the transport seal (plastic film) if you have not already done so. Do not completely remove the vent for filling the cells, but only flip open the top of flip top vent cap & unscrew the cap for easy access. Only special spill-proof vents like SUNICA vents require to be fully removed for electrolyte filling and topping up. Use the correct electrolyte as specified in the technical specification and fill the cells slowly until the level of electrolyte is about 15 mm below the maximum level indication. Check the cells after 30 minutes and add electrolyte upto max, level indication.

9.0 CHARGING

The battery can be charged by all normal constant current and constant voltage methods.

Batteries in parallel operation with charger and load are generally charged with constant voltage.

In operations where the battery is charged separated from the load, charging with either constant current or constant voltage can be carried out.

9.1 ROUTINE CHARGING (DURING USAGE)

During regular usage the charging method and parameters are to be determined by charger, load and battery to ensure the system compatibility.

9.1.1 SEPARATE CHARGING

When the battery is being charged after separating from its load, we recommend 0.2 C rate charging for 7-8 hrs, to recharge a fully discharged battery to full state of charge. A lower charging current can be applied for a proportionally longer time, however the current should not be less than 0.1C A for H type cells, and 0.05C A for L-type and M-type cells.

Constant voltage charging can be used but it requires longer recharge time. The charging parameters are as per high rate charging under clause 9.1.3

9.1.2 PARALLEL OPERATION

For continuous parallel operation with occasional battery discharge, use a float charging voltage in the range of 1.40 to 1.42 volts per cell.

9.1.3 HIGH RATE CHARGING

For recuperative charging of the battery after a discharge, adjust the charging voltages to a level corresponding to:

1-53 – 1.67V/Cell for H cells
1.54 – 1.69 V/Cell for M cells and
1.55 – 1.70 / Cell for L cells

charging current limit should be within 0.1 to 0.2 C_5

9.1.4 OVER CHARGING

Over charging within reasonable limits will not damage the battery, but water consumption will be increased.

9.1.5 UNDER CHARGING

A Ni-Cd battery can be left standing for short periods at any state of charge without damage. But continuous undercharging combined with deep discharging will affect the battery life.

Note: If the battery is continuously on float, it is recommended to boost charge once in every 6 months to make sure that the state of charge is at top. The boost charging should be for such time till there is no change in consecutive readings of 15 minutes duration of cell voltages and which will be approximately 4-5 hours minimum

10.0 MAINTENANCE

10.1 CLEANLINESS

It is important to keep the battery dry and clean. This will contribute to top the performance and maximum service life and non-contamination of cells during topping up. If potassium carbonate crystals (grey white deposits) form on top of the battery, rub with a soft brush and wipe with a clean damp cloth followed by a clean dry cloth. Do not use a wire brush or solvents of any kind, such as gasoline, thinner, acetone, kerosene etc.,

10.2 VENT CAPS

Vent caps should be kept clean to avoid blocking of holes and prevent venting of gases produced during charging.

Vent caps can be removed from the cells, rinsed in clean water, dried and replaced, vent caps can also be cleaned by wiping with a clean damp cloth followed by a clean dry cloth while mounting on the cells.

10.3 CONNECTORS

Check at least once a year that all connectors are tight. This is especially important if the battery is subjected to vibration or shocks during service.

The connectors and terminal screws should be corrosion protected by coating with a thin layer of anti-corrosion oil / petroleum jelly.

10.4 TOPPING UP

The electrolyte level should be always-within the maximum and minimum level marks by replenishing the water.

Use only DM/DI water for toping up.

It is not necessary to add water frequently in an attempt to keep the electrolyte at maximum level.

Never let the level fall below the top of the plates.

Do not add water to the maximum level during high rate charge since accurate level reading is not possible when the battery is gassing.

Avoid splashing water when topping up. A wet battery can result in earth faults and /or erratic operation.

Always keep the flame arresting vents closed except for the moment of topping up.

10.5 NEVER USE SULPHURIC ACID

Sulphuric acid will ruin the alkaline battery.

Filling bottles, hydrometers etc., used with lead acid batteries must never be used with alkaline batteries in order to prevent acid contamination.

10.6 SPECIFIC GRAVITY

The electrolyte specific gravity should be as mentioned in technical specifications.

The specific gravity is not influenced by the state of charge, but increases slightly when the electrolyte level is lowered due to water loss.

Electrolyte specific gravity should not be measured immediately after water has been added.

10.7 CHECKING THE CHARGING

In parallel operation it is great importance that the recommended charging voltage is kept unchanged. The charger should be checked at least once a year.

A high float voltage setting of the charger, which gives higher current than required during float operation, usually causes high water consumption of the battery.

10.8 TROUBLE SHOOTING

Even though Standby Power nickel cadmium batteries themselves are very reliable and trouble free, they are part of a larger system that can introduce abnormal conditions, and batteries are also exposed to different quality of maintenance.

The following list of possible problems, causes and action will be of good use.

S.No.	SYMPTOM	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
01.	Erratic charger behaviour	Wrong polarity of cell, block, row of battery.	Check each cell or block for correct polarity.
		Interruption at connector	Check that no connector or cable is missing and that all connections are tight and cables securely fastened in cable lugs.
		Interruption due to empty cell	Check if the cell is empty because of leakage. If so, remove or short circuit the cell and use the battery with one cell less, until replacement is made. If the cell is part of the block, do not remove the block, just short circuit the cell.
			If the battery is filled with electrolyte on site it could be that one cell has been forgotten. If so, disconnect the cell and fill it with electrolyte.
		Faulty charger	See charger instructions for troubleshooting.

S.No.	SYMPTOM	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
02.	Earth fault indication	Small leak or leaks	Check for wetness on battery stand, or with a voltmeter, area of the battery having the lowest potential to ground. See (1) for procedure if a cell is leaking.
		Battery wet due to overfilling	Disconnect few connectors to avoid high or over boiling voltage and clean the battery. See (8).
		Other equipment of system	Isolate various parts of the DC system to find the fault.
03.	Continuous heavy gassing	Charging voltage is above the recommended float voltage .	See charger instructions for information on charging mode and settings.
04.	No power or capacity at all	Interruption at connector	See SL.No: 1.
		Interruption due to empty cell	See SL.No: 1.
		Battery completely discharged.	Determine why the battery is discharged. The reason could be faulty charger or fuse, wrong float voltage or interruption in the battery. Recharge the battery according to instructions.
05.	Too short discharge time. The voltage decreases quickly at the end.	Too larger load.	The load may be larger that what the battery was intended for. Check the discharge against battery performance data. Note that the rated number of ampere hours can only be delivered at discharges, of 5 hours or longer. For short discharges, batteries will give higher currents but less ampere-hour.
		Insufficient charging.	Determine why the battery is not charged to a correct level. The reason could be low float voltage, no high-rate recharge after previous heavy discharge, too short high-rate recharge, of high-rate recharge to voltage that is too low. Recharge the battery as per instructions and discharge again.
		Too low battery capacity.	If the same result is achieved after full and complete charging, the battery capacity is low. It may still be able to work its application, especially if it is high-rate discharges such as in switchgear operation or engine starting. The reason for low capacity could be age, heavy use, insufficient charging or unsuitable storage.

S.No.	SYMPTOM	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
06.	Low discharge voltage during a major part of discharge.	Very low voltage for one or few cells.	Check the individual cell voltages during discharge and full recharge. If the voltage of an individual cell does not come up nearly as high discharge. As others, the cells have a partial short circuit and therefore not accepting charge. (If the charging voltage is fine but the cell voltage collapses early in the discharge the cell capacity is abnormally low). The reason could be unsuitable handling at installation or contamination in the electrolyte.
		Battery designed with high cell end voltage. The discharge preceded by long-term float charge without discharge.	This condition sometimes occurs if the design cell end voltage is 1.14 – 1.18 volt per cell and the battery has been in service for sometime. It does not mean that the capacity has decreased. It is best handled by using more cells in the battery and thus lowering the final cell voltages, and high rate or boost charging now and then.
07	Too low for engine starting. The engine does not turn at all, or with too low speed to fire	Discharged battery due to insufficient charging	Insufficient charging, See(06)
		Loose connector	Tighten all connectors. For high power discharges this is very important, both from a performance and safety viewpoint. A loose connector will cause voltage drops and can spark and ignite charging gasses.
		Too low temperature	If the temperature is lower than the design temperature for the starting system, it will be difficult to start because the battery gives less power whereas the engine requires more power to turn. Use the correct engine oil for the temperature and try to arrange preheating of the engine and battery if possible.
		Engine trouble	If cranking speed appears to be good, failure to start may depend on the fuel or engine. The battery cannot do more than crank engine at sufficient speed.
08	Wet battery	Overfilling or over boiling	Disconnect a few connectors to avoid high voltage and clean the battery. Use proper filling equipment to avoid overfilling. Over boiling is the result of too high electrolyte level and high rate charging. Normal level and charging at too high rate may also cause over boiling.

S.No.	SYMPTOM	PROBABLE CAUSE	RECOMMENDED CORRECTIVE ACTION
		Sudden eruption of electrolyte from one cell	Disconnect a few connectors to avoid high voltage and clean the battery. Fill the electrolyte or DM/DI water in the cell, which has lost the electrolyte and charge the cell individually. Then replace the cell in the battery and recharge the complete battery. Check the individual cell voltages. If one cell in a battery with high current load such as engine starting is completely discharged it may spew out electrolyte when the high current is applied.
		Electrolyte leakage at posts and vents.	After sometime in service, electrolyte may penetrate the seals around the posts, vents and connectors. In the normal cleaning of the battery, it does not affect the performance of the battery to any extent.
		Electrolyte leakage through pores or cracks.	A leakage through a pore or small crack could be so small that it does not affect the electrolyte level noticeably, but will cause earth faults and the cell or block should be replaced.
09	Uneven electrolyte levels in the battery	Poor filling or topping up.	If the levels of electrolyte vary throughout the battery, the reason is probably poor topping up or leveling off after filling.
		Different float voltages	Batteries are often divided in two halves, which is good from reliability and maintenance viewpoints. If each half has a separate charger and the voltage is different, the electrolyte levels in the two halves will be different
		Leaking cell	If one cell has a lower electrolyte level than all the others, it is probably leaking. The leak could be small and difficult to find, but the battery stand is probably wet from electrolyte under the cell. One individual cell could not consume more water than the others as the same current goes through all cells.
		Short circuit in one cell	A cell with partial or complete short circuit will consume less water than the others. Let the cell remain until replacement is arranged.

11. ELECTROLYTE REPLACEMENT

In most stationery battery applications, the electrolyte will retain its effectiveness for the life of the battery. However, under special battery service conditions, such, as high temperature and / or frequent cycling, potassium carbonate build up in the electrolyte may reach a level that will influence the battery performance. If the potassium carbonate reaches a level of about 25 % of the electrolyte, is said to be carbonized, and the battery performance can be restored to a great extent by replacing the electrolyte.

The type of electrolyte to be used for replacement is given below.

CEL L TYPE	ELECTROLYTE TYPE FOR FIRST FILLING	ELECTROLYTE TYPE FOR REPALCEMENT	ELECTROLYTE TYPE FOR COMMISSIONING IF SUPPLIED DRY
Standard	B-22, Density 1.20	B-5, Density 1.19	B22, Density 1.20
Special Application (Solar)	B-30, Density 1.28	B-12, Density 1.25	B30, Density 1.28

11.1 PREPARATION OF ELECTROLYTE

1000 cc Type B electrolyte contains the following quantities of potassium hydroxide, lithium hydroxide and DM/DI water.

ELECTROLYTE TYPE FOR REPLACEMENT	POTASSIUM HYDROXIDE (88-89%)	LITHIUM HYDROXIDE (55%)	DM/DI WATER
B-5, Density 1.19	276 gms..	9 gms.	910 cc.
B-12, Density 1.25	363 gms.	22 gms.	870 cc.

Use this data as proportions for preparing the electrolyte for the battery in suitable batch quantities depending on the size of the vessels available for electrolyte preparation.

11.2 DISCHARGE

Before emptying the electrolyte, discharge the battery to a voltage corresponding to about 0.6 volt/cell with a current not higher than of 0.2 C_5 Amps. The plates shall never be exposed to atmosphere in charged condition.

11.3 EMPTYING

Open the vents and place the battery inverted to drain the cells. Let the cells drain for about 5 minutes. Do not shake the cells.

Beware of electrolyte splashes.

Do not rinse with water, as this may cause trouble in obtaining correct electrolyte density after filling.

Never let cells remain empty if they are not entirely discharged as this can cause permanent damage.

It is not advisable to pour the used electrolyte into the sink. Follow norms for chemical waste disposal, which are valid in your area.

11.4 FILLING

Immediately after emptying, fill the cells according to the instructions for the electrolyte filling.

11.5 CHARGE

Charge the battery according to the instructions for first charging.

A generous charge is important for the restoration of the battery performance.

11.6 DISPOSAL OF USED BATTERIES

Nickel cadmium batteries must not be discarded as harmless waste and should be treated carefully in accordance with local and national regulations.

Contact Standby Power for disposal and recycling assistance. More than 99% of battery metals can be recycled.

12.0 DO'S AND DO NOT'S

12.1 DO'S

1. Keep the battery always dry and clean. This will prevent leakage of current and protect the nickel-plating on the external battery components.

2. Check inter-cell connectors for proper tightness. This will prevent heat generation at the point of loose contact, which causes damage to the components and can be a fire hazard. Loose contact can also cause battery failure due to creation of an open circuit.

3. Ensure that the cell connections have been made as per the wiring diagram provided. Normally Red washer on cell terminal indicates positive polarity and blue washer indicates negative polarity.

4. Ensure that the battery cable lugs are electro plated. This will prevent the copper from reacting with the electrolyte.

5. Ensure that the transport seal (plastic strip in vent cap) is removed before charging. This will permit escape of the oxygen and hydrogen gases generated during charging.

6. Keep vent caps always closed during charging and discharging. This will prevent the carbon dioxide from the air from combining with the alkaline electrolyte and producing potassium carbonate, thereby reducing the electrical conductivity of the electrolyte.

7. Check the electrolyte level and ensure that it does not fall below the minimum level, which is indicated, on the cell-marking label. This active material contained in the portion of the plates, which are exposed above the electrolyte, will be permanently damaged if the battery remains in service.

8. Use only DM/DI water to top up the cells. (During initial Commissioning use only electrolyte to make up for loss of electrolyte during transportation). Only DM/DI water is to be used to compensate for the loss of water during charging, and maintain the required electrolyte level and specific gravity.

9. Ensure proper functioning of charger and proper connections to the battery. Correct voltage and current settings are important for keeping the battery in charged, ready to use condition.

10. Use insulated tools while working on the battery to prevent accidental short circuit and consequent damage.

11. Use alkaline electrolyte only since this is an alkaline battery.

12.2 DO NOT'S

1. Do not use apparatus, like hydrometers, capillary tubes, and thermometers etc., used in lead acid batteries in order to prevent contamination of electrolyte.
2. Do not use petrol, kerosene, or any strong chemicals for cleaning batteries.
3. Do not use wire or any hard brush to clean deposits on the intercell connectors and terminals since this will damage the nickel plating.
4. Do not use aluminum cables for making connections to the battery terminals since aluminum reacts with the alkaline electrolyte.
5. Do not keep vent caps open and expose electrolyte to air, since this will cause some of the electrolyte to be converted to potassium carbonate and thereby reduce the conductivity of the electrolyte.
6. Do not spill water or electrolyte on and around the battery since this will create conductive paths leading to leakage of current.
7. Do not measure specific gravity immediately after adding DM/DI water since this will indicate a lower specific gravity due to inadequate mixing of the water with electrolyte in the cell. Specific gravity can be measured after one hour.
8. Do not install the Battery in places where it is exposed to sunlight, since this will cause accelerated ageing of plastic components due to ultra violet radiation.
9. Do not remove vent caps (in case of flip type vent caps) for topping up since frequent removal can damage the vent cap and the cell lid. In case of flip type vent caps, gently press the cap to open the spring loaded vent lid and in case of threaded type vent cap, gently unscrew the vent cap lid.
10. Do not use acid since the battery requires alkaline electrolyte. Addition of acid will cause it to react with the alkaline electrolyte, and cause permanent battery damage.
11. Do not charge the battery without removing the transport seal from the vent, or while the battery is covered, since it is important to ventilate the battery and permit the gases produced towards the end of charge to escape.
12. Do not adjust terminal connections during usage to prevent sparking which can ignite the oxygen and hydrogen gases which are given off by the battery towards completion of charge, and cause a fire / explosion.
13. Do not smoke in the battery room since it is a fire hazard.
14. Do not keep Batteries in the same room where acid batteries are kept.

13.0 DM/ DI WATER SPECIFICATION

13.1 PERMITTED IMPURITIES IN WATER

IMPURITY	CALCULATED AS	TOPPING UP WATER MAXIMUM g/l	WATER FOR PREPARATION OF ELECTROYTE MAXIMUM g/l
Chloride	KCl	Traces	0.06
Sulphate	K_2SO_4	Traces	0.05
Nitrate	KNO_3	Traces	Traces
Silico	SiO_2	Traces	Traces
Aluminium	Al_2O_3	Traces	Traces
Calcium & Magnesium	CaO+MgO	Traces	Traces
Heavy Metals		Traces	0.03
Organic impurities	$KMNO_4$	0.03	0.06

Note : Topping up must be with DM/DI water with the conductivity less than 10 micro siemens /cm

14.0 SERVICE LOG

Date of installation and commissioning: _____

Battery No.: _____

Date : _____

CELL NOS	DISCREPANCIES NOTICED	CORRECTIVE ACTIONS / REMARKS

15.0 TOOLS & ACCESSORIES

16.0 DRAWINGS

17.0 TEST CERTIFICATE

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