Installation, commissioning of vented Nickel Cadmium batteries

Installation and Commissioning must be carried out by qualified/competent authorized personnel.
Observe the relevant installation drawing before choosing an installation location. Determine the space requirements before performing the installation. The floor must be suitable for battery installation; it must

– Have a suitable load-carrying capacity,
– The surface must be at equal level, be as free from vibration as possible

1.0 Ventilation source

Sufficient room ventilation is absolutely required to limit the hydrogen concentration (H2 concentration) in the ambient air of the battery room to a value of < 1 % by volume.

Hydrogen is lighter than air. Make sure that hydrogen does not accumulate (e.g., in the ceiling area). Ventilation and De-aeration openings should be placed near the ceiling.

2.0 Environment

The room should be clean and dry. Water, oil and dirt must be kept away from the cell surface.

3.0 Passageway width

HBL recommendation: 1meter in front of and between the battery racks for parallel Rows arrangement, Otherwise, in accordance with local regulations.

4.0 Ventilation

It is impossible to stop gases from being generated while over charging batteries; therefore, the hydrogen concentration in the air must be reduced with sufficient ventilation.

Do not use sparking equipment near batteries. The following could act as sources of ignition

– Flying sparks
– Electrical, sparking equipment
– Mechanical, sparking equipment
– Electro-static charge.

Observe the following measures to prevent any fire:

– Sufficient natural or technical ventilation
– No heating using open flames or glowing objects (T > 300°C)
– Anti-static clothing, shoes and gloves (according to applicable DIN and EN regulations)
– Hand-held lights with power cable without switch (protection class II)
– Hand-held lights with battery (protection category Ip54)
– Warning and regulatory signs.

The ventilation requirements for battery rooms, cabinets or compartments are based on the required reduction of the concentration of hydrogen generated during charging and safety factors which include battery ageing and the potential for fault (“worst case”).

5.0 Receiving The Shipment - Unpacking And Inspection

Do not over-turn the packages

Use forklift only for unloading the pallets containing packing boxes.

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 TO HBL IMMEDIATELY IN CASE OF ANY DAMAGE OR SHORTAGES IN THE CONSIGNMENT.

6.0 Installation – Tools And Equipment

The batteries are delivered on pallets and the required accessories are located in separate packaging units. Observe all information from the previous sections. For the installation, use personal safety equipment, protective clothing, safety tools and other equipment as described below.

HBL battery racks are recommended for proper installation. It is recommended to mount the racks on alkali resistant tiles/ floor. 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.

If 2 battery banks are to be placed side by side OR front to front OR back- back then minimum 800mm gap to be maintained, to ensure there is no floating voltages between the banks and for operational convenience. In case of larger Ah cells, since the cells are arrange with width dimension of the cell side by side, electrolyte level is not visible from front side. Electrolyte level can be checked using capillary tube supplied with the batteries.

It is very important to maintain minimum of 1000mm clearances all-round the racks for easier access to all the cells in all the steps/ rows of cells, to facilitate trouble free maintenance.

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. All rack parts shall be tightened using prescribed fasteners (Refer rack assembling drawing for respective positions) and ensure that no protrusions damage the cells.

Rack assembling – Sequential steps for 1 tier, 2 tier racks:

Please refer enclosed sequential rack assembling instructions for facilitating rack assembling at site.

File names: General Rack Assembly Drawing 2S-2T (pdf file)

General Rack Assembly Drawing 2S-1T (pdf file)

6.1 Cell placing and inter-connection:

While placing the cells on racks also, cell lifting pullers shall be used. Impact loads should not come on the cells while placing the cells on racks, which will damage the cells and cause leakages over a period of time. Care to be taken while placing the cells on top most tier/ step.

Position the cells on the rack suitably so as to permit connection of the positive and negative terminals according to the wiring diagram. Recommended to space out the cells to the maximum possible extent, by utilizing the slots provided on the inter block/ Inter cell connectors. This improves the ventilation. Ensure that the transit caps (blue / black, red), wherever mounted on cell terminals for big size cells. Connect the battery terminals to the equipment only after all the inter-cell, inter-block and inter row cables are connected. It is recommended to keep rubber mat/pad where cells bottom is contacting the rack, especially for voltage systems > 48 V

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If 2 battery banks are to be placed side by side OR front to front OR back- back then minimum 800mm gap to be maintained, to ensure there is no floating voltages between the banks and for operational convenience. In case of larger Ah cells, since the cells are arrange with width dimension of the cell side by side, electrolyte level is not visible from front side. Electrolyte level can be checked using capillary tube supplied with the batteries.

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Follow The Polarity To Avoid Short Circuiting Of The Cells.

Bolt Diameter	Recommended Torque
M6	7.5 Nm (0.75 Kg (f) -m)
M10	30 Nm (3.0 Kg (f) -m)

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 in above table:

Ensure correct torque by using an appropriate torque wrench. For small cells (with M6 terminals), sufficient care to be taken to hold the cells at the time of torqueing. 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.

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. This is not applicable for the batteries as they are sent in pre-filled condition.

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.

Please refer the enclosed file for Specification for DM/DI water.

DM/DI water specification:

Always maintain the level electrolyte between the MAX & MIN level by adding DM/DI water when ever required.

Refer the below table for specification of DM/DI water, extracted from IEC 60993,an IEC standard for Electrolyte for Ni Cad batteries.

	General appearance	Clear and colourless
	pH	5 - 9
	Conductivity at +20 °C · freshly prepared · after storage	 ≤ 10 µS/cm ≤ 30 µS/cm
	Total dissolved solids	20 mg/dm^3
Critical	Chloride as KCl	20 mg/dm^3
Major	Iron as Fe Calcium as CaO Magnesium as MgO	10 mg/dm^3 15 mg/dm^3 15 mg/dm^3
Minor	Sulphate as K_2SO_4 Silica as SiO_2 Oxidizable carbon as $KMnO_4$ consumption	20 mg/dm^3 2 mg/dm^3 30 mg/dm^3

Electrolyte Type	Potassium Hydroxide (88-90%)	Lithium Hydroxide (55%)	Demineralised Water
B-22, Density	268 gms	40 gms	890 cc

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 DM/ DI 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. (> 80 degree C). The container used shall be able to withstand this temperature.

After cooling to room temperature, adjust the density as required within a tolerance of +/-0.01 by adding D.M/ DI water. Specific gravity of the electrolyte does not change with the state of charge of the battery, unlike in lead acid batteries.

7.1 Apparatus

Use only clean vessels of plastic or steel for preparing the electrolyte, which can withstand temperatures up to 100 Degree C. 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.

Use only electrolyte approved by HBL Power Systems Limited, for our Ni-Cd batteries.

7.2 Safety Precautions

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.

8.0 Charging

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

8.1 First Charging (during Commissioning)

8.1.1 Commissioning of battery supplied in Filled and charged condition

The batteries supplied in Filled and charged condition are ready for direct installation within three months of dispatching from factory.

8.1.2 Commissioning of battery supplied in Filled and discharged condition

First charging can be administered for the batteries supplied in Filled and discharged condition. Multiple charge- discharge cycles are required, to get the full capacity of the battery, which can be terminated, once it meets rated capacity

8.1.3 First charging:

Charge the battery with the current recommended in the Technical specifications (Clause 2.0). The duration of charge should be such that a charge input of 200% of C5 Ah is given. Good commissioning charge is very important for obtaining best out of the battery and it's longevity. The maximum (peak to peak) ripple current in the charger output should not exceed 5 % of the rated Ah of the battery.

Refer table for 1st charging procedure steps, in next page.

Note: For battery banks with multiple strings in parallel, it is recommended to charge and discharge the strings individually as per procedure outline in next page. Followed by that, multiple strings can be connected in parallel before putting in to float condition. This helps in equalization of all the cells in all strings.

Despatch condition of cells	Commissioning Procedure 3 to 6 months	Commissioning Procedure
Filled and charged	1. Discharge the battery bank at 0.2C5 A up to 1.00 V/ cell, followed by discharging at 0.1C5 A until 0.6 V/cell. 2. Provide rest period of minimum 12 hours. 3. Charge the battery for 10 hours with 0.2C5A. 4. Put the battery bank in float mode.	1. Discharge the battery bank at 0.2C5 A up to 1.00 V/ cell, followed by discharging at 0.1C5 A until 0.6 V/cell. 2. Provide rest period of minimum 12 hours. 3. Charge the battery for 10 hours with 0.2C5A. 4. Rest for 1-2 hours 5. Repeat steps 1 to 3 6. Put the battery bank in float mode

Despatch condition of cells	Commissioning Procedure
Dry and discharged	1. Charge the battery for 10 hours with 0.2C5A. 2. Rest for 1-2 hours. 3. Discharge the battery at 0.2C5 A until 1.0V/cell, followed by discharging at 0.1C5 A until 0.6 V/cell. 4. Provide rest period of minimum 12 hours. 5. Charge the battery for 10 hours with 0.2C5A. 6. Put the battery bank in float mode.
Filled and discharged	1. Charge the battery for 10 hours with 0.2C5A. 2. Rest for 1-2 hours. 3. Discharge the battery at 0.2C5 A until 1.0V/cell, followed by discharging at 0.1C5 A until 0.6 V/cell. 4. Provide rest period of minimum 12 hours. 5. Charge the battery for 10 hours with 0.2C5A. 6. Put the battery bank in float mode.

While charging, ensure that the charger current does not get limited during the entire charging duration. Cell voltages are expected to reach up to 1.85 Volts and "required overall voltage" shall be possible to set in the charger.

In case of constraint in the charger to keep this voltage, then divide the battery into two halves, to be charged individually.

If, full performance from the battery is required immediately (for capacity testing purpose), discharge can to be carried out , before putting the battery in float charging, as mentioned above. (i.e. after last charging step outlined in the above table)

For cells stored in filled & charged/ filled & discharged condition for >1 year, please contact HBL for commissioning instructions. Filled cells can be stored for a maximum period of 1 year, but if the storage period exceeds 6 months from date of dispatch of the cells from factory, charge- discharge cycle need to be carried out.