

ELECTROLYTE PREPARATION AND CHANGING ELECTROLYTE INSTRUCTIONS

SAFETY PRECAUTIONS

ELEKTROLYTE

The alkaline electrolyte is a strong caustic agent. Remove all rings, watches and other metal parts. Wear rubber gloves, eye protection (splash goggles or face shield) and long-sleeved clothing when working on the battery or with electrolyte. Before working with electrolyte, make sure that water for washing is easily available. If electrolyte is splashed on the skin, eyes, or clothing, wash immediately with plenty of water. In all cases get immediate medical attention.

KEEP FLAMES AWAY

During the last portion of charging, the battery will emit gases (oxygen & hydrogen) that can be explosive. Ventilation is required to avoid a hydrogen concentration of more than 4% hydrogen volume in air. Also, check local regulations for proper ventilation. Do not tighten or unscrew any connections while charging or the first hour after charging. Discharge any possible static electricity from clothes by touching an earth connected part (ground). Never smoke in the battery room / area.

TOOLS

Use tools with insulated handles. Do not place or drop metal objects on top of the battery. Copper, zinc, aluminium, or galvanized vessels must not be used for mixing electrolyte.

WARNING

Do not add water to solid (dry) electrolyte.

WARNING: Review all safety procedures prior to working with cells / batteries (provided by the applicable authority and/or battery manuals/instructions). Always follow applicable international or local regulations.

1. PREPARATION OF ELECTROLYTE

Electrolyte

The electrolyte for vented nickel-cadmium cells is an aqueous solution of potassium hydroxide (KOH) and lithium hydroxide (LiOH) mixed in distilled or deionized water. The maximum electrolyte impurities for newly prepared electrolytes and water used shall comply with IEC 60993. The designation of the electrolyte to be used in the cells is "E" type. Refer to the cell's "Installation and operating instructions" sheet for the type of electrolyte required.

Packaging and Storage

Ready-made "E" type liquid electrolyte is delivered in plastic containers. Solid electrolyte for preparation on site is delivered in plastic containers, cardboard boxes, or metal drums depending on size of the package. The potassium hydroxide (pellets) and the lithium hydroxide (crystals) are packed in separate sealed plastic bags. The plastic bags are placed in their respective outer package.

Tools

For preparation of electrolyte, use clean vessels of plastic or stainless steel that can withstand temperatures of up to +100°C. Copper, zinc, aluminium, or galvanized vessels must not be used. For the vessel size, check the Table B for the amount of electrolyte to be made based on the package supplied. Accessories used for lead-acid batteries must not be used with nickel-cadmium batteries.

Dissolving

Refer to the Table B for the applicable "E" type electrolyte and the quantity of distilled or deionized water required per kg of solid (dry) electrolyte. It is absolutely necessary to use distilled or deionized water (refer to chapter guarantee conditions) for preparing electrolyte or topping-up. Ordinary water, even drinking water, contains impurities that will affect the battery life and operation. To obtain a proper composition mixture of the liquid electrolyte, use the ENTIRE contents of KOH and LiOH from the package along with the specified amount of distilled or deionized water in one batch. Stirring must be carried out carefully in each step below until all is dissolved.

1. Pour a little less distilled or deionized (totally desalted) water than stated in the Table B, into a vessel.
2. Pour the LiOH into the water and mix until it is all dissolved to a solution.
3. Add the KOH-pellets cautiously to the solution and mix carefully until the pellets are completely dissolved.
4. The solution will become hot. Allow the electrolyte to cool down to room temperature (+20/25°C) and adjust the density (specific gravity) to the values given in Table B by adding distilled or deionized water.

Guarantee Conditions

Use only electrolyte approved by the battery manufacturer. It shall be based on the maximum values of impurities as defined in the IEC 60993 for the electrolyte and purified water. The distilled or deionized water used for new electrolyte or topping-up, must comply with the following characteristics:

- * Clear and colourless, odourless while boiling
 - * Conductivity at +20°C:
freshly prepared = 10 µS/cm
after storage = 30 µS/cm
 - * pH 5 - 9
- The maximum acceptable impurities are :
- * Chloride as KCl 20 mg/dm³
 - * Iron as Fe 10 mg/dm³
 - * Calcium as CaO 15 mg/dm³
 - * Magnesium as MgO 15 mg/dm³

Filling of cells

Open the cell vents and remove the transport seals. Fill the cells to about 20 mm above the lower level mark with electrolyte. Wait 4 to 24 hours and add electrolyte if the level has dropped prior to commissioning. Follow the cell's "Installation and operating instructions" sheet for proper commissioning.

Cell Oil

Generally, most pocket plate cell types require cell oil while sintered/pbe cells do not require any. Check the "Installation and operating instructions" sheet for the cell type used to confirm if cell oil is required, the quantity for each cell, and the various sections referring to the electrolyte and commissioning instructions. The cell oil must be ordered in addition to the electrolyte and is delivered in a separate package. The cell oil shall be put into the cell 4 hours **after the commissioning of the battery**. A graduated syringe is required to add the cell oil according to the quantity indicated in the Table A of the cell's "Installation and operating instructions" sheet. The oil layer should be approximately 5 mm thick on top of the electrolyte. Check the electrolyte level and adjust it to the upper level mark by adding electrolyte. The battery is now ready for use. No electrolyte should be added later. For normal topping-up, only distilled or deionized water should be used.

2. CHANGING OF ELECTROLYTE FOR POCKET PLATE CELLS

Note: Some pocket plate cell types do not require an electrolyte change or the electrolyte must never be drained. Refer to the cell's "Installation and operating instructions" sheet to verify for the cell type used.

Preparation of electrolyte

The above instructions shall be followed when preparing the electrolyte solution.

Discharge

Discharge the battery to a cell voltage of max 0.6 V with a current discharge of 0.2 I_A or lower. This discharge is not required if the cells are filled with new electrolyte within 20 minutes after drainage.

Drainage

Warning:

- Beware of electrolyte splashes.

Caution:

- Do not pour any electrolyte into a sink or drain. Dispose of the used electrolyte according to local regulations and requirements.
- Do not rinse with water as this may cause trouble in obtaining correct electrolyte density after filling.
- Never let the cells remain empty if they are not entirely discharged. This can cause permanent capacity losses and heat generation that can lead to a fire.
- Remove the vents. Remove the electrolyte by using a pump, or if that is not possible place each cell upside down to drain.
- It is not necessary to shake the cells to get the entire old electrolyte out.

Filling of cells

Immediately after drainage, fill the cells to about 20 mm above the lower level mark with the applicable electrolyte. Wait 4 to 24 hours and add electrolyte if the level has dropped prior to commissioning. Follow the cell's "Installation and operating instructions" sheet for proper commissioning. Commission the battery even if it has not been discharged. Follow the instructions from the above sections called "Cell oil".

Table B

Electrolyte Type	Amount of Water Required litres/kg solid electrolyte	Electrolyte Density (Specific Gravity) before filling kg/dm ³	Total Amount of Electrolyte litres/kg solid electrolyte
E4	3.10	1.20	3.40
E12	2.25	1.25	2.60
E13	2.85	1.21	3.20
E21	2.03	1.27	2.38
E22	2.74	1.21	3.09
E30	1.96	1.28	2.31
E40	2.56	1.21	2.91

Notes:

- Tolerance on the amount of water required and the total amount of electrolyte produced is ± 0.1 litre/kg of solid (dry) electrolyte.
- The density tolerance in new electrolyte solution is ± 0.01 at +20°C (before filling). After the cells are filled, the electrolyte density will change due to absorption in plate stacks, level changes, evaporation, etc.