

Maintenance Instructions

FUKUDA

FUKUDA NICKEL CADMIUM BATTERIES

WITH PLASTIC CELL CONTAINERS

Receiving the Shipment

Checking Check the consignment.

Shipping method I: The battery is shipped filled and charged. Remove tight shipping plugs if used. Check the electrolyte level in all cells and add electrolyte if leaking has occurred during the transport. The battery is ready for use.

Shipping method II: The battery is shipped empty and discharged. Remove tight shipping plugs if used. Then follow instructions for **First Filling** and **First Charge**.

First filling: Prepare the electrolyte for the first filling which is supplied in solid form. See instructions on page 2, Preparation of Electrolyte. Pour the electrolyte solution into the cells to the upper level mark. Close the vents.

First charge: Charge at the recommended 7-hour rate but for 10 hours and check the voltage of each cell during charge. The battery is now ready for use.

General

Installation: Install the battery in a well-ventilated place where it cannot be exposed to excessive heat, open fire or chemical agents. The gases from the battery are **not corrosive** and the battery can thus be placed close to machinery.

Temperature: Batteries are more efficient and longer lived when working at a temperature between 10 and 30°C. A temperature over 45°C should, if possible, be avoided. FUKUDA standard batteries can be kept in service down to -20°C. For services below this temperature your FUKUDA agent should be consulted.

Care: Keep battery clean and dry. Possible salt deposits are easily wiped off with a wet cloth. Plastic cell

containers must not be cleaned with organic dissolvent such as kerosene, benzene, thinner, acetone, trichloroethylene, etc.

Storage: Batteries which are to be stored for periods up to one year should be charged before putting in storage. If the storing time has exceeded 3 months, the batteries should be given a normal charge before putting in services again.

If storing for longer periods than one year is considered your FUKUDA agent should be consulted

Caution! The electrolyte is caustic. If splashed on skin or clothing, rinse with 3 % boric acid solution.

Charging

Separate charging: When the battery is being charged separate from its load, we recommend charging for 7h with the current stated in the table overleaf. A lower current can be applied for a proportionally longer time, but the current should not be less than 50% of the table value for KAP-KPH cells, or less than 25% for other cell types. The charging can also be done with receding current provided that the battery receives the required charge, $1.4 \times C$ ($C =$ rated capacity). When charging with receding current, the end current should not be less than the minimum values stated above. At separate charging, the charging voltage required is approximately 1.65V/cell.

Parallel operation: In most application, the battery works continuously in parallel with a charger. Most often, the charger is a constant voltage rectifier dimensioned for the whole load. Under such circumstances, there is a load on the battery only when the charger is out of function owing to mains failure or some fault. In normal

operation the charger shall maintain a voltage corresponding to 1.40 ± 0.02 V/cell (float charging).

It must be possible to raise the voltage of the charger to a level corresponding to 1.55- 1.65 V/cell, either manually or automatically, for recuperative charging of the battery after a discharge.

If, in parallel operation of battery - charger, the load is causing periodical discharges of the battery, the charging voltage for normal service must be higher than 1.40V/cell.

Depending on the type of service, the required voltage varies from 1.50 to 1.55 V/cell. Contact your FUKUDA agent for information.

E.g.: Batteries for engine cranking: about 1.50V
Intermittent service: about 1.55V

Vents: It is not necessary to open the vents during charging.

Checking of the charger: In parallel operation, it is of great importance that the recommended charging voltage is maintained. Checking of the charger should be done at least once yearly, including checking of any existing automatic charging device.

Electrolyte



DO NOT USE SULPHURIC ACID

Electrolyte level: Each cell has two level marks, maximum level and minimum level. The electrolyte level should be kept between these marks. Top up with distilled water when necessary. The cells have a thin layer of cell oil on the top of the electrolyte.

Density: Normally 1.17-1.19 (21 - 23°C) at the normal electrolyte level. If the density should drop below the normal value, add electrolyte.

Changing the Electrolyte: Under some circumstances, changes in the electrolyte can cause an impairment of the battery's performance capability. If such a change should be observed, it may be necessary to change the electrolyte. For checking of the electrolyte, contact FUKUDA agent.

Changing of the electrolyte is done in the following way:

Discharge: The battery is discharged to a voltage corresponding to 0.6-0.8 V per cell. This discharge is, however, not required, if the cells will be filled with new electrolyte within one hour after the drainage.

Drainage: Open the vents. Place the battery upside down to drain the cells. Do not shake the cells and do not rinse with water. The cells have to be in this position for 15-20 minutes.

Filling: Fill the cells with recommended type of FUKUDA nickel cadmium electrolyte with a density of 1.17-1.19 up to maximum level.

Cleaning: Clean the battery.

Charging: Charge the battery according to the instruction for normal charging but for 10 hours.

Checking: Check the density and the electrolyte level in all cells some hours after charge.

Preparation of Electrolyte

Safety Precautions: The alkaline electrolyte is a strong caustic agent. Use rubber gloves, eye protection and long-sleeved clothing when working with electrolyte. Make sure that water for washing is easily available. If electrolyte is accidentally splashed on the skin or clothing, flood immediately with water and wash for 10-15 minutes. If eyes are affected, flood with water and call for professional medical attention.

Electrolyte Types: The alkaline electrolyte is a solution of potassium hydroxide (KOH) in distilled or deionized water (A-type). The B-types of electrolyte also contain a

certain percentage of lithium hydroxide (LiOH). The following types are used depending on battery application. Electrolyte renewal is needed only under special battery service conditions.

<u>for first filling</u>	<u>for electrolyte renewal</u>
A	A
B 20	B 5
B 50	B 12

Package and Storage: The potassium hydroxide pellets are delivered in plastic bottles. Lithium hydroxide for B-type electrolyte is packed in a separate plastic bag located on top of the pellets in the bottle. Both the solid and the liquid electrolyte must be stored in air-tight vessels. Do not open the electrolyte packages until immediately before use. Store at a dry place.

Tools: For preparation of electrolyte, use clean vessels of plastic or steel. Copper, aluminium or galvanized vessels must not be used. Use no accessories for lead-acid batteries.

First Filling: Open the cell vents and, for new cells, remove the transport seal.

Dissolving: To obtain proper solution of the electrolyte, use the whole contents of a bottle in one batch. Pour the pellets together with the lithium hydroxide cautiously into distilled or deionized water in the proportion:

1 kg of solid electrolyte – 3.3 L of water

Stir carefully with a plastic paddle until the pellets are completely dissolved. The liquid will become hot. After cooling to room temperature, adjust the density (spec. gravity) to 1.18 ± 0.01 by adding deionized water.

Exception: If the electrolyte is to be used for first filling of new cells with steel containers, use 2.6 litres of water to 1 kg of solid electrolyte. In this case, do not adjust the density until after filling and first charging.

First Filling: Open the cell vents and, for new cells, remove the transport seal. Fill the cells slowly to a level well over the minimum but not to maximum level. Check the cells after 30 minutes and add electrolyte if the level has sunk considerably.

First Charging: The vents may be closed during charging. The first charging should be made with constant current. Charge with the recommended 7-hour current (see Maintenance Instructions) but extend the charging time to 10 hours. Other charging rates can be used if the charging time is adjusted to give the same number of ampere hours. Note that for the first charge, the charging current should be preferably at least 50 % of the 7-hour current. In some cases, the rectifier high-rate charging voltage is not high enough to keep the charging current at the recommended level during the whole charging period. If so, charge one-half of the battery at a time. A generous first charge is important for obtaining maximum battery performance.

A couple of hours after finishing first charge, add electrolyte to maximum recommended level. At the same time check the density and make adjustment if needed. For cells filled to maximum recommended level the electrolyte density shall be 1.18 ± 0.01 .

Renewal of Electrolyte

Preparation of Electrolyte: Follow above instructions

Discharge: Discharge the battery entirely. The open circuit voltage after discharge shall correspond to 0.5-0.8 V/cell. This discharge is not required if the cells are filled with new electrolyte within 20 minutes after the drainage.

Drainage: Open the vents and place the battery upside down to drain the cells. Beware of electrolyte splashes. Let the cells drain for 5-10 minutes. Do not shake the cells. 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 - THEY CAN BE PERMANENTLY DAMAGED.

Notice: it is not advisable to pour the used electrolyte into the sink. Follow norms for chemical waste products which are valid in your area.

Filling and Charging: Immediately after drainage, fill the cells according to the above instruction. Charge the batteries according to the above instruction for first charging and adjust electrolyte level and density.

Technical data					
Cell Type	Capacity Ah @ 10 h rate	Capacity Ah @ 5 h rate	Charging Current Amps for 7 h	Electrolyte per cell	
				Solution (L)	Solid (kg)
KAP 1	10		2.0	0.25	0.07
KAP 2	17		3.4	0.35	0.10
KAP 3	30		6.0	0.60	0.16
KAP 5	45		9.0	0.80	0.22
KAP 6	60		12	1.00	0.27
KAP 10	95		19	1.50	0.41
KAP 13	125		25	1.80	0.49
KAP 18	175		35	1.75	0.47
KAP 20	205		41	2.3	0.62
KAP 23	230		46	3.6	0.97
KAP 25	250		50	3.4	0.92
KAP 29	290		58	3.1	0.84
KAP 32	320		64	5.4	1.46
KAP 35	350		70	5.1	1.38
KAP 42	415		83	4.5	1.22
KPM 1		13	2.6	0.40	0.11
KPM 2		18	3.6	0.35	0.10
KPM 3		30	6.0	0.50	0.14
KPM 5		50	10	0.70	0.19
KPM 7		70	14	0.8	0.22
KPM 10		100	20	1.3	0.35
KPM 13		130	26	1.6	0.43
KPM 16		160	32	3.9	1.05
KPM 19		185	37	3.6	0.97
KPM 24		235	47	3.1	0.84
KPM 29		285	57	5.2	1.41
KPM 33		330	66	4.9	1.32
KPH 1		8.5	1.7	0.22	0.06
KPH 2		15	3.0	0.35	0.10
KPH 3		25	5.0	0.50	0.14
KPH 4		40	8.0	0.65	0.18
KPH 6		55	11	0.85	0.23
KPH 8		80	16	1.3	0.35
KPH 10		100	20	1.7	0.46
KPH 14		125	25	2.4	0.65
KPH 15		150	30	3.4	0.92
KPH 19		190	38	5.2	1.41
KPH 25		235	47	4.7	1.27