

### Handling Precautions and Guideline for Lithium Ion (LO) batteries

#### General

1. The customer is strongly advised to contact DYNAMIS in advance in case the application or operating conditions of the battery will differ from those specified in the specification sheet. Additional testing may be necessary to verify the suitability of the particular cell type for the intended use.
2. DYNAMIS will take no responsibility whatsoever for any accident due to use of the battery other than specified by DYNAMIS.
3. Improvements or changes for the proper use and handling of the cell will be forwarded to the customer in cases necessary.

#### Handling

##### 1. Charge

###### 1.1 Charge current

The maximum charging current specified is not to be exceeded during use. Application of a higher current than that may cause damage to the cell with respect to electrical or safety-related performance. Unusual heat generation or leakages may be a result of over charge.

###### 1.2 Charge voltage

A maximum charge voltage of 4.2 V per cell is recommended by DYNAMIS. At voltages higher than 4.3 Vpc damages may occur and result in the same like described in 1.1

###### 1.3 Charge temperature

The recommended temperature range of the specification shall not be exceeded.

###### 1.4 Reverse charge

Reverse charging is strongly prohibited. DYNAMIS recommends a polarity check of the cell before assembly or connection to a charging device. Reverse charge may cause serious damage of any kind to the cell.

##### 2. Discharge

###### 2.1 Discharge current

The discharge current specified by DYNAMIS is not to be exceeded due to possible damage to the cell. The damage will result in reduced capacity and/or unusual heat generation.

###### 2.2 Discharge temperature

The recommended temperature range of the specification shall not be exceeded.

###### 2.3 Over discharge

The cell shall not be discharged to lower voltages than specified (cut-off voltage). Deeper discharge than that will result in reduced cell performance and may cause damage to the cell.

Over discharge also occurs if the self-discharge is not compensated during long periods of storage time. For cases like this, the OCV of the cell is to be

checked. For voltages lower than 3.7 V re-charge is recommended.

For optimum performance, discharge cycles to the specified end voltage are preferred in terms of cycle numbers achieved.

### 3. Protection Circuit Module (PCM)

- 3.1 The use of a PCM is recommended for all types of LO batteries in order to protect the cell and enable best performance with respect to the application.
- 3.2 The over-charge protection function shall stop charging if the voltage exceeds the recommended value.
- 3.3 The over-discharge prevention shall work to minimize dissipation current to avoid a drop of the cell voltage below 2.5 Vpc or less. The protection function shall monitor each bank of a Li Ion battery pack and control the current.

### 4. Storage

The storage conditions specified shall not be exceeded in order to assure proper cell function and prevent the battery from damages.

### 5. Handling Advice

- 5.1 The performance of mechanical, thermal and electrical treatments described in the respective specification is not to be exceeded. Damages of any kind may result in different hazards as described in the MSDS.
- 5.2 LO batteries can be damaged by application of heat of any kind. This may result in emission of gas and(or) electrolyte. Do not overheat.
- 5.3 The LO batteries are to be protected against any possibility of short-circuit. The very high currents generated by short-circuit will cause severe damages, heat generation and emission of gas, smoke and/or fire.

### 6. Advice for battery pack design

- 6.1 Fixation inside a battery pack is to be achieved. No cell movement shall be allowed inside the pack.
- 6.2 The design of the pack shall be appropriate not to emit heat in case of leakages due to mishaps.
- 6.3 The PCM is to be protected as good as possible from eventual contact with leak electrolyte.
- 6.4 The common state of good practice is necessary in all kinds of design of a battery pack, e.g. proper insulation of wiring and layers, sufficient spacing between different voltage patterns and so on.
- 6.5 The PCM design shall be made with respect to the case of leaked electrolyte touching the circuit patterns. Short circuits must be prevented by cover material.

### 7. Battery pack assembly

- 7.1 Shocks, high temperature or contact with sharp edge tooling shall not be applied during battery pack assembly.
- 7.2 Soldering or welding of wires etc directly on LO contacts is to be avoided. Temperatures above 80 °C will cause damages to the cells.

### 8. Further

- 8.1 Disassembly of cells is strongly prohibited.
- 8.2 Dumping of LO cells and batteries into fire, water or other conductive liquids is strongly prohibited.
- 8.3 Damaged cells shall be prevented from any further use.
- 8.4 Mechanical damages can occur during transport. If damages like leakages, smelling of electrolyte or other abnormal features are found the particular cell shall not be used anymore.
- 8.5 After the use of LO cells the appropriate way of disposal has to be followed.