

# BATTERIES, CELLS



Batteries **Ni-Cd** (nickel-cadmium), **Ni-MH** (nickel-metal hydride), **Li-Ion** (lithium-ion) and **LiFePO4** (lithium-iron-phosphate) are used to supply emergency lighting power supply.

As standard, the battery leads are 20 cm outside the battery outline and are terminated with a N-type connector, adapted to the plug mounted in HYBRYD emergency power supply systems.

## OPERATING CONDITIONS

|                                   | Ni-Cd       | Ni-MH       | Li-Ion       | LiFePO4      |
|-----------------------------------|-------------|-------------|--------------|--------------|
| Cell temperature during charging  | 0°C – +55°C | 0°C – +55°C | 0°C – +60°C  | 0°C – +60°C  |
| Cell temperature during operation | -5° – +60°C | -5° – +60°C | -20° – +60°C | -20° – +60°C |

Ni-Cd and Ni-MH battery obtain full electrical parameters after **three complete** charge and discharge cycles.

With the fulfillment of proper operating conditions, battery capacity measured by a 0.1C discharge current should not fall below **60%** of its rated capacity within a period of **48 months** from the date of manufacture.

The number of charge/discharge cycles during this time period should not exceed **300**.

The battery-powered system controls the battery voltage cut-off to protect against deep discharge.

## BATTERY VOLTAGE AND CAPACITY

The batteries are made up of individual battery cells connected in series (**L**). Single cell voltage (**N**) is 1,2V (for Ni-Cd, Ni-MH), 3,7V (for Li-Ion) and 3,2V (for LiFePO4). The battery voltage is: **L x N**.

Depending on the type and power of the LED module and the required lighting efficiency, HYBRYD emergency power supply systems are powered by a battery consisting of 2, 3, 4, 5 and 7 cells.

The battery capacity depends on the execution of the system's current and the required emergency operation time. The mostly used capacities are shown in the table below:

| Ni-Cd | Ni-MH | Li-Ion | LiFePO4 |
|-------|-------|--------|---------|
| 1,5Ah | 1,6Ah | 0,7Ah  | 0,6Ah   |
| 2,5Ah | 2,1Ah | 2,2Ah  | 1,5Ah   |
| 4,0Ah | 4,0Ah |        | 2,0Ah   |

## PACKING TYPE - MOUNTING

As standard, the batteries are packing in series or in parallel. If a different way of battery cells packing is required, it is recommended to contact HYBRYD.

**Ni-Cd** batteries of PAR and PAS type are mounted using clamps or cable ties. **Ni-MH** batteries of PAR, PAS, PAP, PAK, PAC, PAD type are mounted using cable ties.

- Suitable for use in high temperature (up to 60°C)
- Selected packages are also available in thermostated version, which allows them to be used at reduced temperatures (from -20°C)
- Many ways of packing
- High current efficiency
- Low self-discharge
- Long life
- No memory effect (Li-Ion, LiFePO<sub>4</sub>)
- Fast charging process



The most commonly used types of packing:

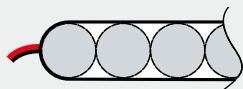
**PAO** type - (Ni-Cd, Ni-MH; 3,6-8,4V) battery packed in series, can be equipped with clamps



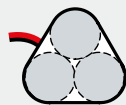
**PAS** type - (Ni-Cd, Ni-MH; 3,6-8,4V) battery packed in series, without clamp



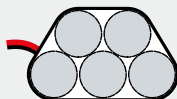
**PAR** type - (Ni-Cd, Ni-MH; 3,6-8,4V | Li-Ion; 3,7V | LiFePO<sub>4</sub>; 3,2V) battery packed in parallel



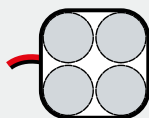
**PAP** type - (Ni-Cd, Ni-MH; 3,6V) 2 cells located in parallel and the third placed on them



**PAK** type - (Ni-Cd, Ni-MH; 6,0V) 3 cells located in parallel and two placed on them



**PAC** type - (Ni-Cd, Ni-MH; 4,8V) 4 cells arranged in a cuboid



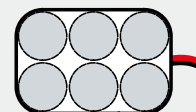
**PAD** type - (Ni-Cd, Ni-MH; 8,4V) double cuboid, arranged with 7 cells



**PAJ** type - (Li-Ion; 3,7V | LiFePO<sub>4</sub>; 6,4V)



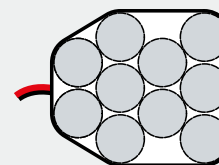
**PAE** type - (Ni-Cd, Ni-MH; 7,2V)



**PAL** type - (Ni-Cd, Ni-MH; 4,8V; 7,2V)



**PAT** type - (Ni-Cd, Ni-MH; 12,0V)



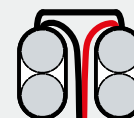
**PAB** type - (Ni-Cd, Ni-MH; 3,6V; 6,0V; 8,4V)



**PAN** type - (Ni-Cd, Ni-MH; 3,6V; 6,0V; 8,4V)



**PAW** type - (Ni-MH; 4,8V)



## DIMENSIONS AND WEIGHTS

### Ni-Cd PAO

| Battery code | NP      | R   | D   | S  | H  | M   |
|--------------|---------|-----|-----|----|----|-----|
| PAO-36-15    | 3,6/1,5 | 152 | 167 | 27 | 28 | 170 |
| PAO-36-25    | 3,6/2,5 | 168 | 183 | 30 | 31 | 240 |
| PAO-36-40    | 3,6/4,0 | 207 | 222 | 25 | 37 | 370 |
| PAO-48-15    | 4,8/1,5 | 198 | 211 | 27 | 28 | 220 |
| PAO-48-25    | 4,8/2,5 | 220 | 235 | 30 | 31 | 310 |
| PAO-48-40    | 4,8/4,0 | 263 | 278 | 25 | 37 | 480 |
| PAO-60-15    | 6,0/1,5 | 238 | 253 | 27 | 28 | 220 |
| PAO-60-25    | 6,0/2,5 | 271 | 286 | 30 | 31 | 370 |
| PAO-60-40    | 6,0/4,0 | 326 | 341 | 25 | 37 | 590 |
| PAO-84-15    | 8,4/1,5 | 327 | 341 | 27 | 28 | 320 |
| PAO-84-25    | 8,4/2,5 | 373 | 388 | 30 | 31 | 500 |
| PAO-84-40    | 8,4/4,0 | 440 | 454 | 25 | 37 | 820 |

### Ni-Cd PAS

| Battery code | NP      | L   | D  | M   |
|--------------|---------|-----|----|-----|
| PAS-36-15    | 3,6/1,5 | 125 | 23 | 150 |
| PAS-36-25    | 3,6/2,5 | 145 | 26 | 220 |
| PAS-36-40    | 3,6/4,0 | 180 | 33 | 350 |
| PAS-48-15    | 4,8/1,5 | 170 | 23 | 200 |
| PAS-48-25    | 4,8/2,5 | 195 | 26 | 290 |
| PAS-48-40    | 4,8/4,0 | 240 | 33 | 460 |
| PAS-60-15    | 6,0/1,5 | 215 | 23 | 200 |
| PAS-60-25    | 6,0/2,5 | 245 | 26 | 350 |
| PAS-60-40    | 6,0/4,0 | 300 | 33 | 570 |
| PAS-84-15    | 8,4/1,5 | 301 | 23 | 300 |
| PAS-84-25    | 8,4/2,5 | 345 | 26 | 480 |
| PAS-84-40    | 8,4/4,0 | 420 | 33 | 800 |

### Ni-Cd PAR

| Battery code | NP      | L   | D  | H  | M   |
|--------------|---------|-----|----|----|-----|
| PAR-36-15    | 3,6/1,5 | 70  | 44 | 23 | 150 |
| PAR-36-25    | 3,6/2,5 | 76  | 52 | 26 | 220 |
| PAR-36-40    | 3,6/4,0 | 100 | 63 | 33 | 350 |
| PAR-48-15    | 4,8/1,5 | 94  | 44 | 23 | 200 |
| PAR-48-25    | 4,8/2,5 | 104 | 52 | 26 | 290 |
| PAR-48-40    | 4,8/4,0 | 134 | 63 | 33 | 460 |
| PAR-60-15    | 6,0/1,5 | 117 | 44 | 23 | 200 |
| PAR-60-25    | 6,0/2,5 | 130 | 52 | 26 | 350 |
| PAR-60-40    | 6,0/4,0 | 167 | 63 | 33 | 570 |
| PAR-84-15    | 8,4/1,5 | 163 | 44 | 23 | 300 |
| PAR-84-25    | 8,4/2,5 | 182 | 52 | 26 | 480 |
| PAR-84-40    | 8,4/4,0 | 233 | 63 | 33 | 800 |

### Ni-MH PAD

| Battery code | NP      | L    | H1 | H2 | S    | M   |
|--------------|---------|------|----|----|------|-----|
| PAD-84-40    | 8,4/4   | 143  | 37 | 35 | 18,5 | 490 |
| PAD-84-21    | 8,4/2,1 | 102  | 34 | 32 | 17   | 266 |
| PAD-84-16    | 8,4/1,6 | 96,4 | 29 | 27 | 14,5 | 182 |

### Ni-MH PAS

| Battery code | NP      | L    | S    | D   | M   |
|--------------|---------|------|------|-----|-----|
| PAS-48-40    | 4,8/4   | 280  | 18,5 | 6,7 | 280 |
| PAS-48-21    | 4,8/2,1 | 200  | 17   | 6,5 | 152 |
| PAS-48-16    | 4,8/1,6 | 193  | 14,5 | 6,5 | 104 |
| PAS-36-40    | 3,6/4   | 210  | 18,5 | 6,7 | 210 |
| PAS-36-21    | 3,6/2,1 | 150  | 17   | 6,5 | 114 |
| PAS-36-16    | 3,6/1,6 | 145  | 14,5 | 6,5 | 78  |
| PAS-24-40    | 2,4/4   | 140  | 18,5 | 6,7 | 140 |
| PAS-24-21    | 2,4/2,1 | 100  | 17   | 6,5 | 76  |
| PAS-24-16    | 2,4/1,6 | 96,5 | 14,5 | 6,5 | 52  |

### Ni-MH PAR

| Battery code | NP      | L    | H  | S    | M   |
|--------------|---------|------|----|------|-----|
| PAR-48-40    | 4,8/4   | 73,5 | 72 | 18,5 | 280 |
| PAR-48-21    | 4,8/2,1 | 68   | 52 | 17   | 152 |
| PAR-48-16    | 4,8/1,6 | 58   | 50 | 14,5 | 104 |
| PAR-36-40    | 3,6/4   | 55   | 72 | 18,5 | 210 |
| PAR-36-21    | 3,6/2,1 | 51   | 52 | 17   | 114 |
| PAR-36-16    | 3,6/1,6 | 43,2 | 50 | 14,5 | 78  |
| PAR-24-40    | 2,4/4   | 37   | 72 | 18,5 | 140 |
| PAR-24-21    | 2,4/2,1 | 34   | 52 | 17   | 76  |
| PAR-24-16    | 2,4/1,6 | 29   | 50 | 14,5 | 52  |

### Ni-MH PAP/PAK/PAC

| Battery code | NP      | L    | H  | S    | M   |
|--------------|---------|------|----|------|-----|
| PAP-36-40    | 3,6/4   | 73,5 | 35 | 18,5 | 210 |
| PAP-36-21    | 3,6/2,1 | 51   | 32 | 17   | 114 |
| PAP-36-16    | 3,6/1,6 | 48,5 | 27 | 14,5 | 78  |
| PAK-60-40    | 6/4     | 73,5 | 35 | 18,5 | 350 |
| PAK-60-21    | 6/2,1   | 51   | 32 | 17   | 190 |
| PAK-60-16    | 6/1,6   | 48,5 | 27 | 14,5 | 130 |
| PAC-48-40    | 4,8/4   | 73,5 | 37 | 18,5 | 280 |
| PAC-48-21    | 4,8/2,1 | 51   | 34 | 17   | 152 |
| PAC-48-16    | 4,8/1,6 | 48,5 | 29 | 14,5 | 107 |

### LEGEND:

NP - battery voltage (V)/battery capacity (Ah); L - packet width (mm); D - packet length (mm); H - package height (mm); R - spacing of mounting holes (mm); S - cell width (mm); M - mass (g).

Approximate dimensions of singles cells:

### Ni-Cd

| Cell capacity | Diameter | Length |
|---------------|----------|--------|
| 4,0Ah         | 33mm     | 60mm   |
| 2,5Ah         | 26mm     | 50mm   |
| 1,5Ah         | 23mm     | 43mm   |

### Ni-MH

| Cell capacity | Diameter | Length |
|---------------|----------|--------|
| 4,0Ah         | 19mm     | 71mm   |
| 2,1Ah         | 17mm     | 50mm   |
| 1,6Ah         | 14mm     | 48mm   |

### Li-Ion

| Cell capacity | Diameter | Length |
|---------------|----------|--------|
| 2,2Ah         | 18mm     | 65mm   |

### LiFePO4

| Cell capacity | Diameter | Length |
|---------------|----------|--------|
| 1,5Ah         | 18,3mm   | 65,1mm |

## CONNECTOR TYPE

For all types of batteries we use type N connectors as standard (other on special order).



## ORDERING

|  | BATERIA | T | 0000 | - | NC | - | PAS | - | 24 | - | 20 | - | N | - | 20 | - | T20 | - | Z |
|--|---------|---|------|---|----|---|-----|---|----|---|----|---|---|---|----|---|-----|---|---|
| Battery type:  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>A</b> - battery pack  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>T</b> - thermostated battery                                  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>PCM</b> - PCM battery   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| Variant:   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>0000</b> - main variant, thermostat + fastening <sup>1)</sup> |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>0001</b> - thermostat without fastening                       |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| Cell type:   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>NC</b> - Ni-Cd  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>NH</b> - Ni-MH  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>LI</b> - Li-Ion   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>LF</b> - LiFePO4  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| Packing:   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>PAO</b>   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>PAS</b>   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>PAR</b>   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| ... - (see PACKING TYPE)   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| Battery voltage:   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>24</b> - 2,4V; 2 cells (Ni-Cd, Ni-MH)                         |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>32</b> - 3,2V (LiFePO4)                                       |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>36</b> - 3,6V; 3 cells (Ni-Cd, Ni-MH)                         |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>37</b> - 3,7V (Li-Ion)  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>48</b> - 4,8V; 4 cells (Ni-Cd, Ni-MH)                         |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>60</b> - 6,0V; 5 cells (Ni-Cd, Ni-MH)                         |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>64</b> - 6,4V; 2 cells (LiFePO4)                              |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>84</b> - 8,4V; 7 cells (Ni-Cd, Ni-MH)                         |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| Battery capacity:  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>06</b> - 0,6Ah  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>10</b> - 1,0Ah  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| ...  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>40</b> - 4,0Ah  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| Battery cable:   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>10</b> - 10cm   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| ...  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>20</b> - 20cm   |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| Thermostat cable: (for thermostated battery)                     |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>T5</b> - 5cm  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| ...  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>T20</b> - 20cm  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| Cable outlet direction: (for thermostated battery)               |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>P</b> - opposite  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |
| <b>Z</b> - consistent  |         |   |      |   |    |   |     |   |    |   |    |   |   |   |    |   |     |   |   |

<sup>1)</sup> in the case of a thermostated battery