CEAG


STAR TECHNOLOGIE

# Mounting and Operating Instructions

## Battery Cabinets

Target group, part 1: Qualified electricians acc. to DIN VDE 0105, part 1

Target group, part 2: Electrical instructed persons

COOPER Safety

## Index

## Index

# Important Notes

## 1. General Information

### 1.1 Description of Symbols

Important safety notes are marked with symbols in these instructions.

Theses stated notes have to be observed essentially.

**WARNING! Risk of Injury or Death!**
**Signifies notes which, when not observed, can cause impairment of health, (steady) injury or death.**

**! ATTENTION! Damage to Property!**
**Signifies notes which, when not observed, can cause damage to property and even the collapse of the system.**

**NOTE!**
**Includes important hints and advice that is important for failure - free operation.**

### 1.2 Information regarding these instructions

These operating instructions show the safe and proper handling of the battery. The stated safety notes and instructions as well as the local accident prevention- and safety regulations have to be observed.

Before working with the battery, the instructions have to be read carefully, especially the chapter ”Safety instructions“.

### 1.3 Further Applicable Documents

In the battery systems, components from other manufacturers are mounted (batteries). These purchasing – components are checked according to danger evaluation by the manufacturer. They declare the compliance of the construction with the European and national regulations.

### 1.4 Liability and Guarantee

All information and notes in these instructions are compiled according to the valid regulations, the state of the art, our long - standing knowledge and experience.

Keep the instructions near to the battery system, accessible for every person working with the battery and at all times.

Read the instructions carefully before working on and with the battery!

### 1.5 Copyright Protection

All information from the contents, text, drawings, pictures and further representations are protected with regard to copyright.

### 1.6 Spare Parts

Only use original spare parts from the manufacturer.

**! ATTENTION!**
**Wrong or faulty spare parts can cause damage, failure or collapse of the system. Take care to ensure the same charging state when changing the battery blocs.**

When using unapproved spare parts, all guarantee, service, damage and liability claims are forfeited.

## 1.7 Recycling

Lead-acid batteries are recyclable products. Recognising the need to be involved in the whole life - cycle of a battery and to protect the environment, EXIDE Technologies factories recycle used lead.
Contact your CEAG Notlichtsysteme representative who will advise you on this matter.
This is also valid for used blocks.
For the transport of used accumulators special regulations set out, so it is recommended to commission a special transport or trade company for issuing the freight documents and packing this material!!

## 2 Safety

The battery is designed and built in conformity with the latest technical rules at the time of its development and production, so it is safe to operate. Danger maybe presented by the battery, if it will is used for other than the intended purpose and by unskilled personnel.

For any operation on the batteries, from storage to recycling, the following safety rules should be observed:

- Read the „Installation Instructions“ and „Operating Instructions“ of stationary closed lead acid batteries carefully.
- Do not smoke.
- Even when disconnected, a battery remains charged. The metal parts of the battery are always electrically active.
- Use insulated tools.
- Never place tools on the batteries (metal tools are particularly dangerous).
- Check the starting torque of the block connector when the bolted assembly is insecure (see Appendix).
- Never lift the cells / monoblocs at the terminals.
- Avoid shocks.
- Never use synthetic cloth or sponge to clean the cells / monoblocs. Use water (wet cloth) without additives.
- Discard metallic items like watches or jewelry.

## 2.1 Intended Use

Battery cabinets are exclusively for power supply to an emergency lighting system.

The operating safety can only be guaranteed by intended use of the battery cabinet / battery racks.

**! Attention!**

**Every use beyond or different than the intended purpose is prohibited, and therefore not in accordance with regulations! Battery cabinets are exclusively for emergency – power supply.**

## 2.2 Contents of Operating Instructions

Every person, ordered to work with the battery, has to read the instructions carefully to understand them before work begins. This takes also place when the person has already worked with a similar kind of battery or was instructed by the manufacturer.

## 2.3 Changes and Modifications to the Battery

To avoid danger and to assure optimum performance, changes and modifications to the battery are not allowed, except when the manufacturer has approved them.

## 2.4 Responsibility of the Operator

Keep the instructions near to the battery system, accessible for every person working with the battery and at all times.

Battery must be in a proper and safe condition when using it. Battery has to be checked for intactness before using it.

Adhere to the information of the instructions completely!

## 2.5 Personnel Requirements

Only authorised and skilled personnel are allowed to work on and with the battery. The personnel must have received instructions regarding the existing danger.

Skilled personnel refers to those with expert training, with knowledge and experience as well as knowledge of the relevant regulations. He should be able to evaluate his work and recognize the presence of danger.

Personnel without the necessary knowledge must be trained.

## 2.6 Operational Safety

Observing the stated safety instructions and regulations can avoid damage to property and people when working with the battery.

## 2.7 Personal Protective Equipment

When working on and with the battery it is necessary to wear:

- **Protective Clothes**
  Close fitting protective clothes (low tensile strength, no wide arms, no rings and further jewelry, etc.).

- **Safety Boots**
  Boots electrostatic conductive according to EN 345.

## 2.8 Danger caused by the Battery

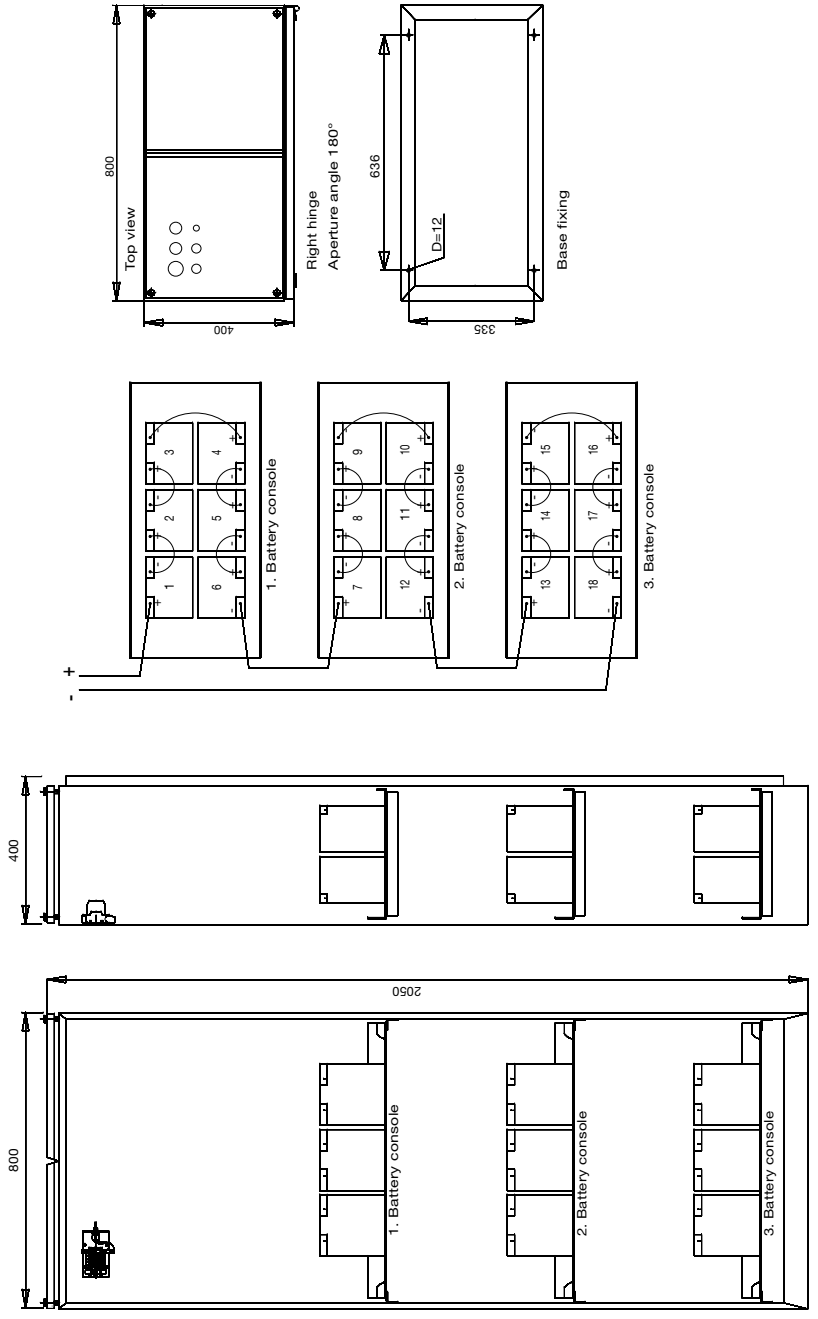
The battery was subjected to a danger analysis. Therefore the construction and design of the battery meets the actual state of the art.

With proper handling the battery is operationally safe.

## 3. Technical Data / Battery Installation

### 3.1 Standard - Battery Cabinets

#### 3.1.1 Standard - Battery Cabinet 23.3 Ah




**Wiring Set 4 0071 346 779 included**

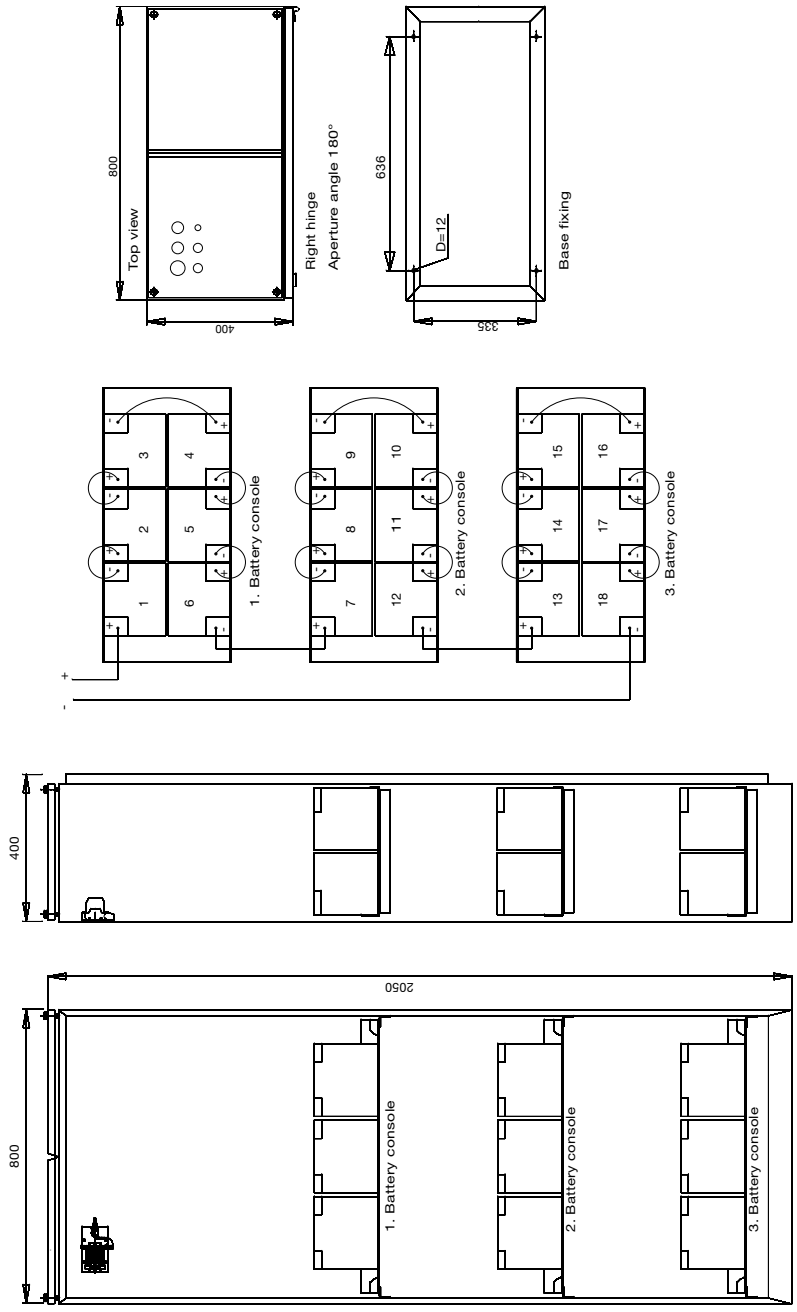
| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 15 |
| 2 | 800 mm | 2 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 23.3 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 168 x 127 x 174 |
| final pole | M6 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. Batteries | 295 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 400 |
| Order no. batterie bloc | 40066070461 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.2 Standard-Battery Cabinet 32 Ah




**Wiring Set 4 0071 346 779 included**

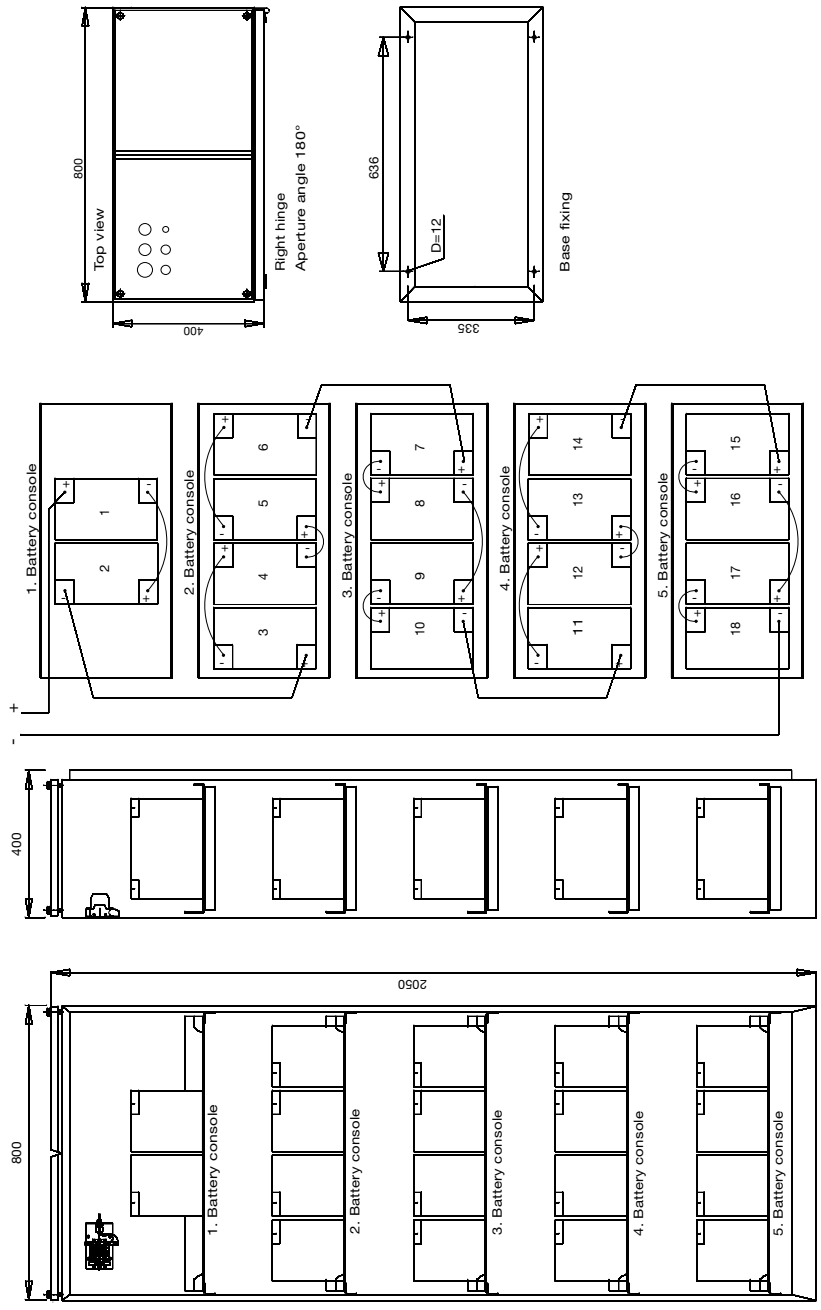
| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 15 |
| 2 | 800 mm | 2 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 32 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 198 x 168 x 175 |
| Final pole | M6 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 370 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 400 |
| Order no. Battery bloc | 40066070116 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.3 Standard-Battery Cabinet 49.5 Ah




**Technical Data**

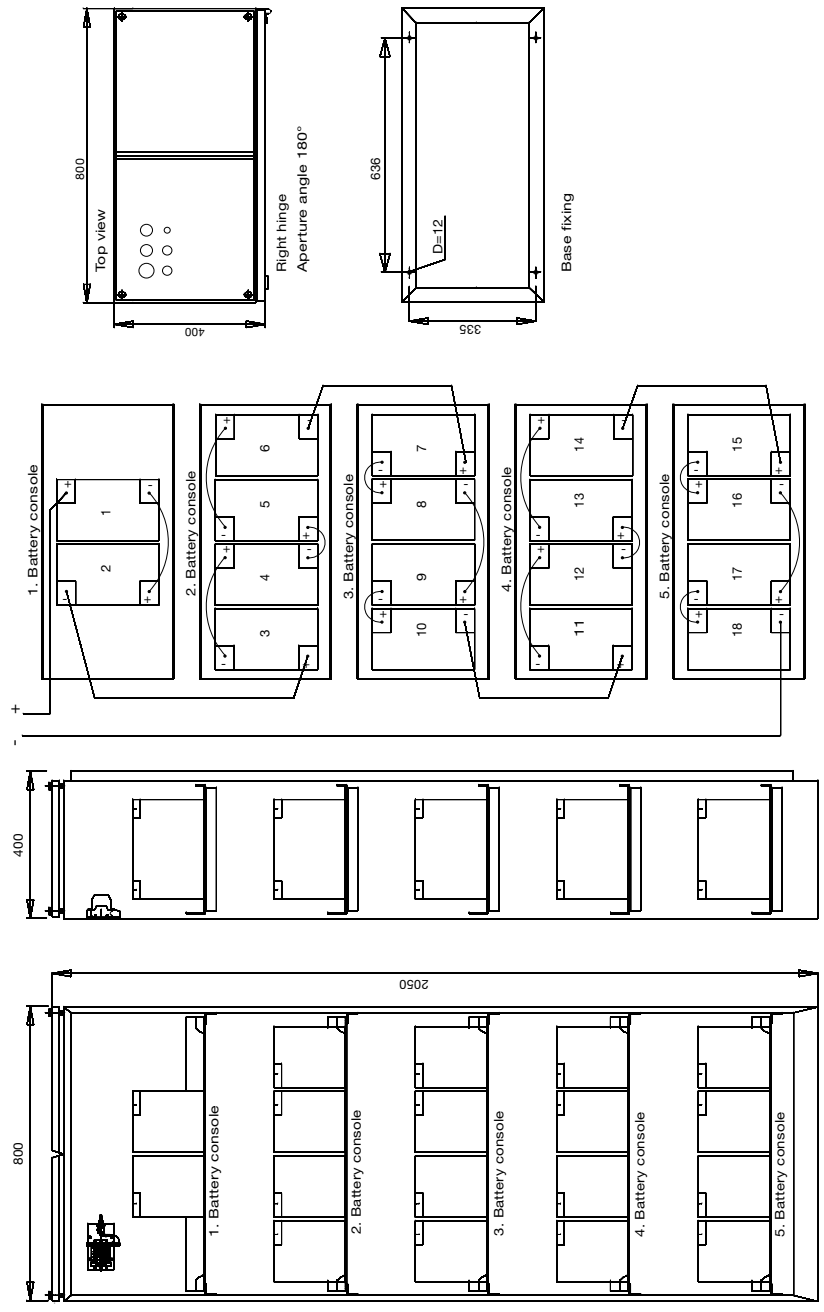
| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 49.5 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 234 x 169 x 190 |
| Final pole | M6 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 495 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 400 |
| Order no. of battery bloc | 40066070463 |

**Wiring Set 4 0071 347 446 included**

| No. | Length | Number |
|---|---|---|
| 1 | 360 mm | 13 |
| 2 | 800 mm | 4 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.4 Standard-Battery Cabinet 55 Ah




**Wiring Set 4 0071 347 446 included**

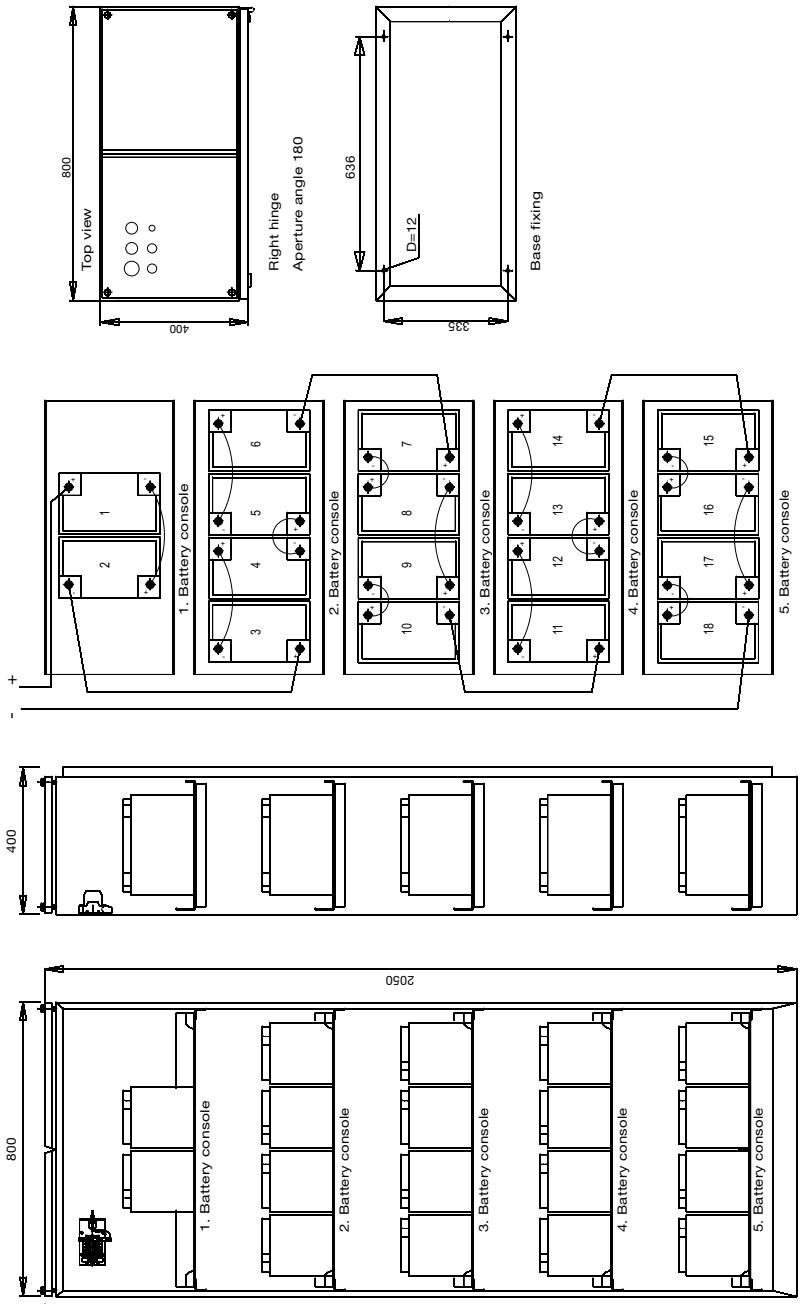
| No. | Length | Number |
|---|---|---|
| 1 | 360 mm | 13 |
| 2 | 800 mm | 4 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 55 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 272 x 166 x 190 |
| Final pole | M6 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 540 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 400 |
| Order no. of battery bloc | 4006607011 8 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.5 Standard-Battery Cabinet 59.2 Ah




**Wiring Set 4 0071 346 778 included**

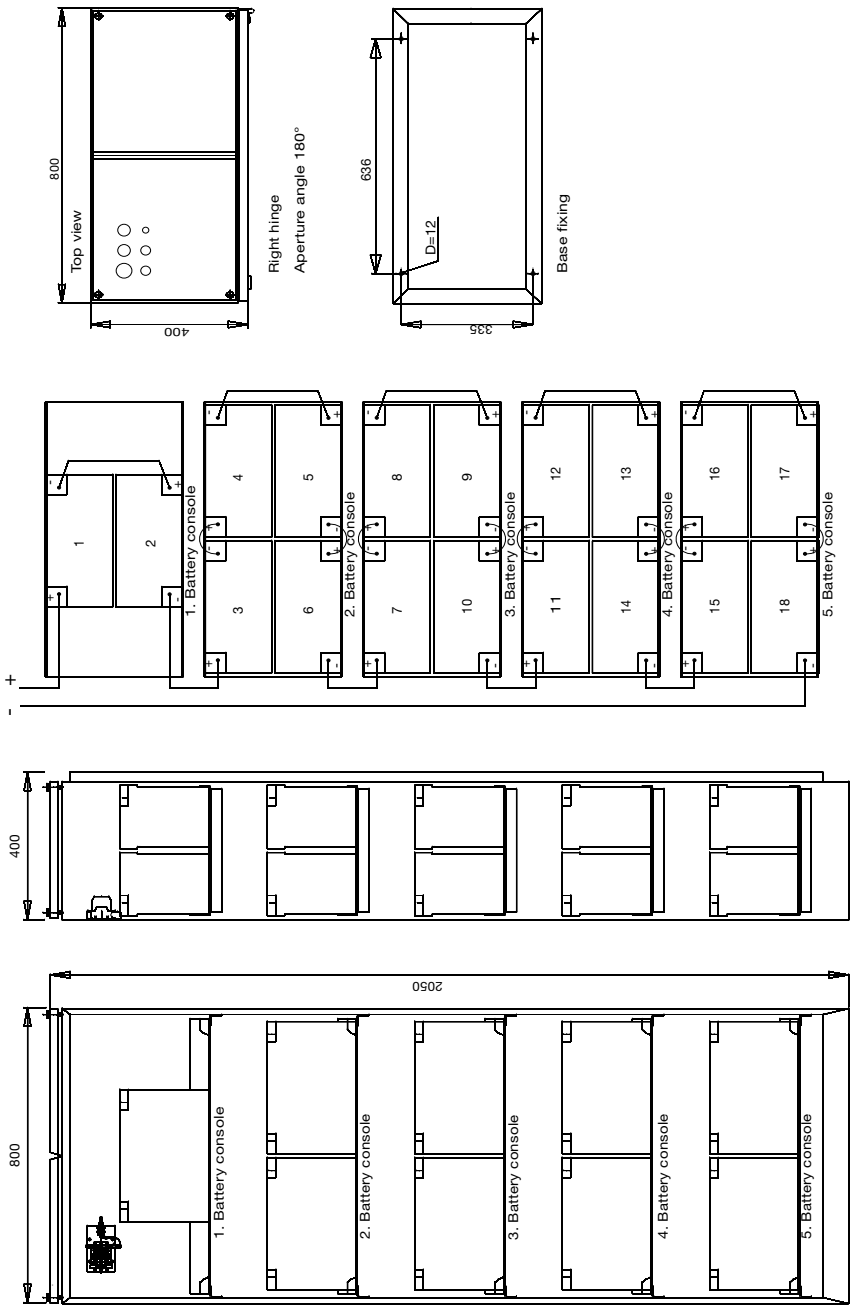
| No. | Length | Number |
|---|---|---|
| 1 | 440 mm | 13 |
| 2 | 800 mm | 4 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 59.2 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Batteriy dimensions in mm (L x B x H) | 272 x 166 x 190 |
| Final pole | M6 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. batteries | 570 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 400 |
| Order no. of battery bloc | 40066070464 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.6 Standard-Battery Cabinet 80 Ah




**Technical Data**

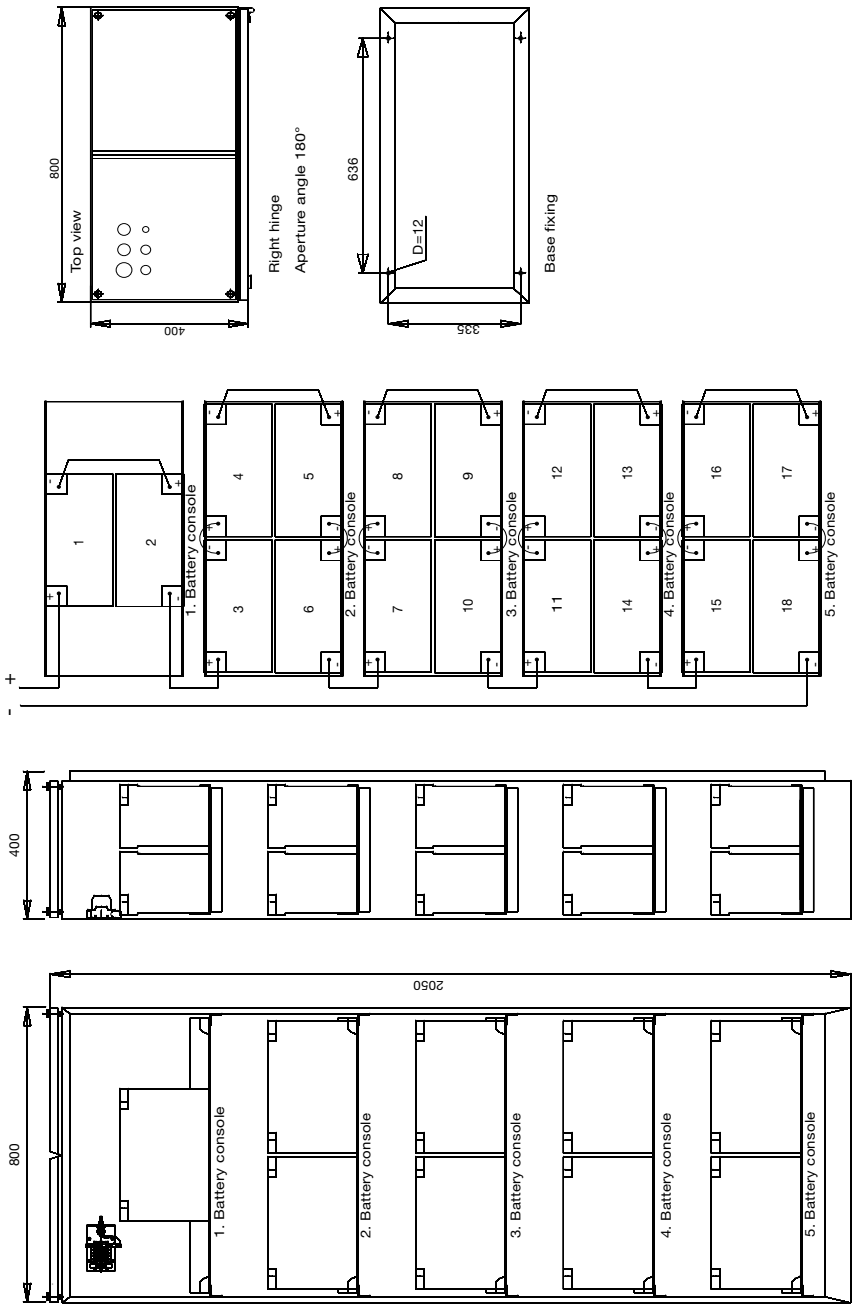
| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 80 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x B x H) | 359 x 172 x 226 |
| Final pole | M8 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 685 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 400 |
| Order no. of battery bloc | 40066070120 |

**Wiring Set 4 0071 346 777 included**

| No. | Length | Number |
|---|---|---|
| 1 | 350 mm | 13 |
| 2 | 800 mm | 4 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.7 Standard-Battery Cabinet 89.4 Ah




**Wiring Set 4 0071 360 230 included**

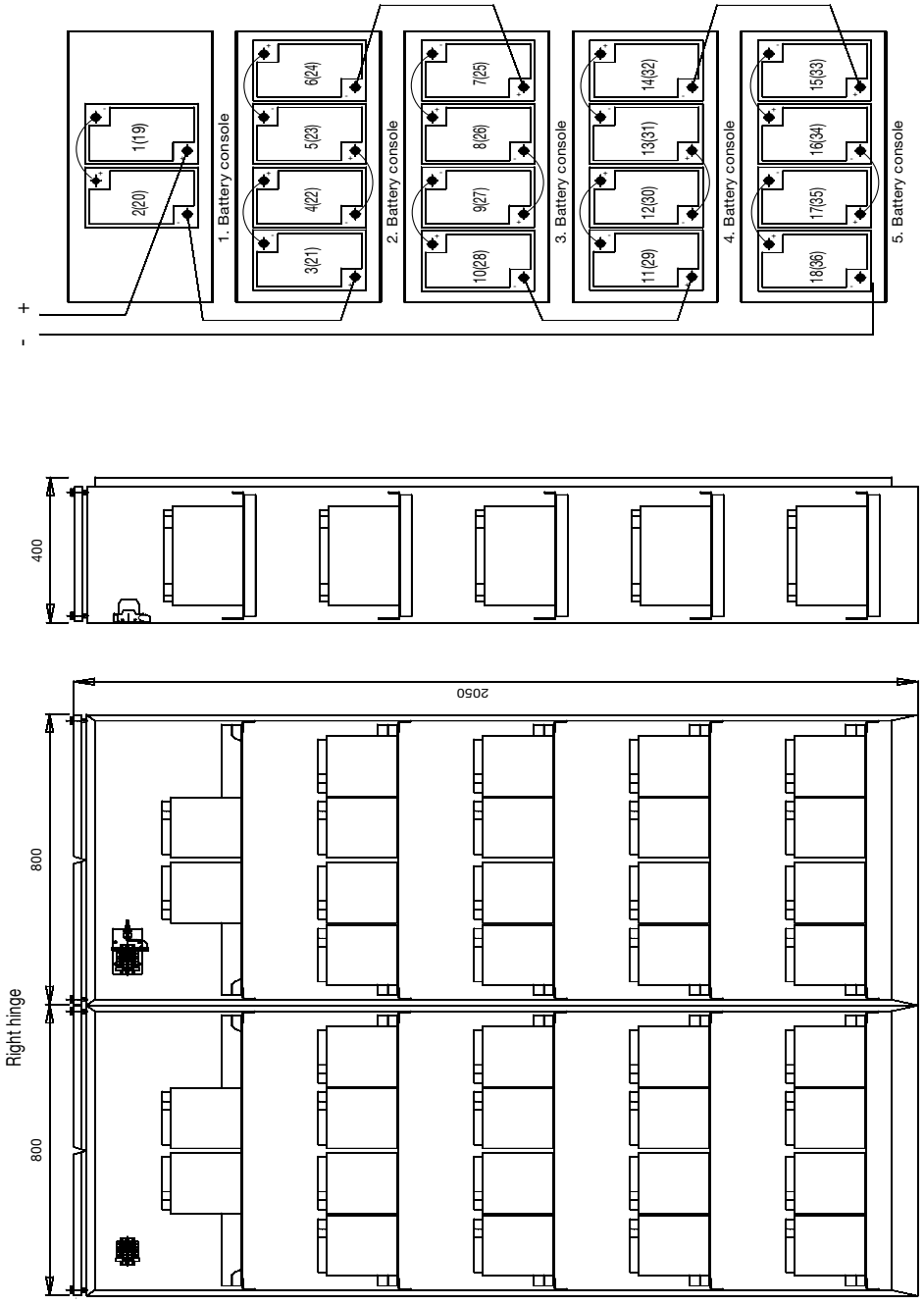
| No. | Length | Number |
|---|---|---|
| 1 | 350 mm | 13 |
| 2 | 800 mm | 4 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 89.4 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 307.5x 171 x 239 |
| Final pole | M6 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. Batteries | 750 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 400 |
| Order no. of battery bloc | 40066070821 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.8 Standard-Battery Cabinet 118 Ah




**Wiring Set 4 0071 346 775 included**

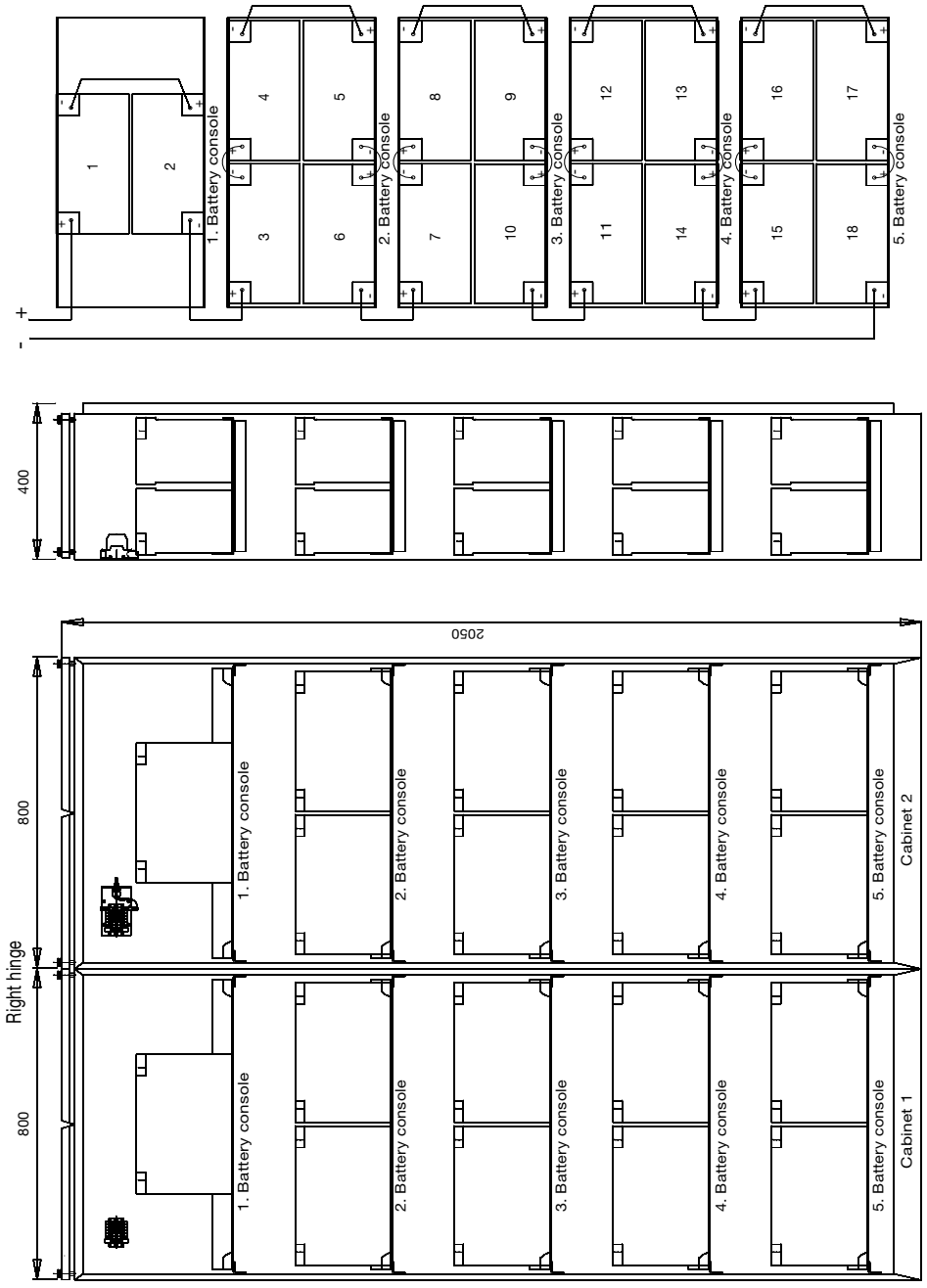
| No. | Length | Number |
|---|---|---|
| 1 | 350 mm | 26 |
| 2 | 800 mm | 8 |
| 3 | 800 mm | 2 |
| 4 | 2000 mm | 2 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 6 V / 118 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 36 á 6 V |
| Battery dimensions in mm (L x B x H) | 272 x 166 x 190 |
| Final pole | M8 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. Batteries | 1200 kg |
| Dimensions in mm (B x H x T) | 2 x (800 x 2050 x 400) |
| Order no. of battery bloc | 40066070466 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.9 Standard-Battery Cabinet 160 Ah




**2 x Wiring Set 4 0071 346 777 included**

| No. | Length | Number |
|---|---|---|
| 1 | 350 mm | 13 |
| 2 | 800 mm | 4 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

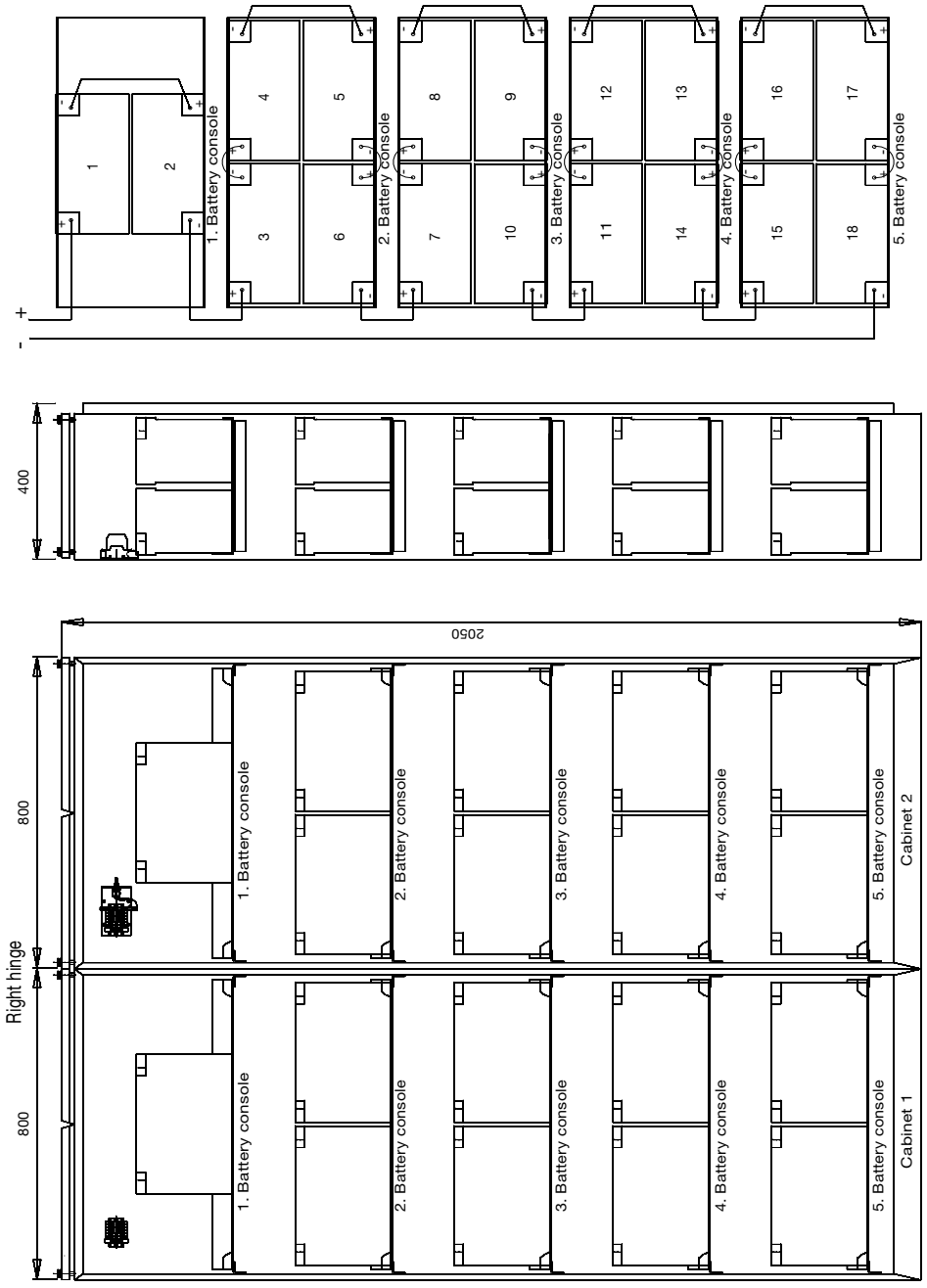
**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 80 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 36 á 12 V |
| Battery dimensions in mm (L x B x H) | 359 x 172 x 226 |
| Final pole | M8 |
| Supply terminals | max. 35 mm² |
| Weight incl. Batteries | 1380 kg |
| Dimensions in mm (B x H x T) | 2 x (800 x 2050 x 400) |
| Order no. of battery bloc | 40066070120 |

**Standard-Battery Cabinet 160 Ah (2 x 80 Ah)**
The battery cabinets 160 Ah will be built of two parallel connected cabinets 80 Ah by using the battery distribution panel (40071346700) according to mounting circuit diagram.

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.10 Standard-Battery Cabinet 178.8 Ah




**2 x Wiring Set 4 0071 360 230 included**

| No. | Length | Number |
|---|---|---|
| 1 | 350 mm | 13 |
| 2 | 800 mm | 4 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

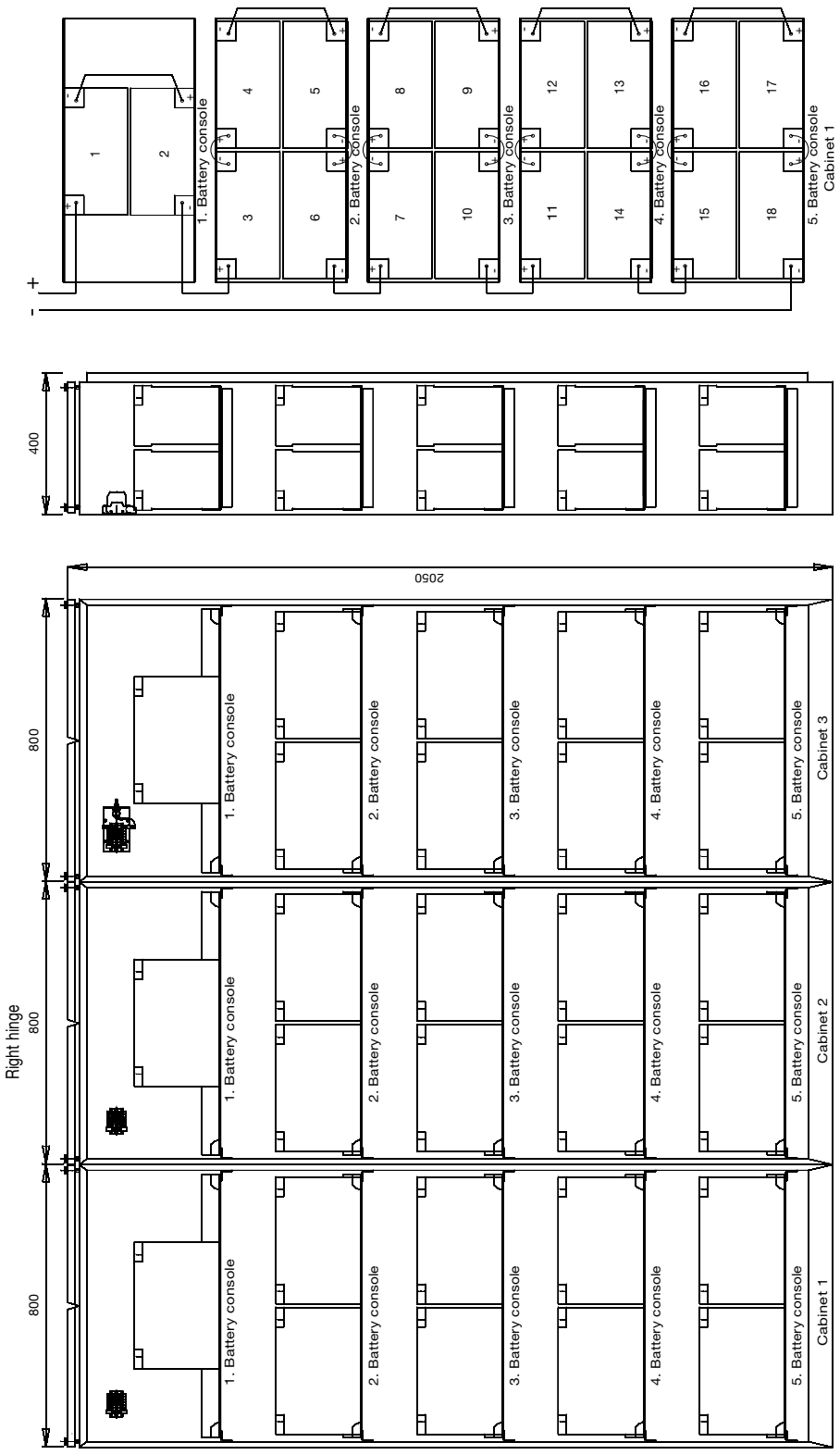
**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 89.4 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 36 á 12 V |
| Battery dimensions in mm (L x B x H) | 307.5 x 171 x 239 |
| Final pole | M6 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. Batteries | 1500 kg |
| Dimensions in mm (B x H x T) | 2 x (800 x 2050 x 400) |
| Order no. of battery bloc | 40066070821 |

**Standard-Battery Cabinet 178.8 Ah (2 x 89.4 Ah)**
The battery cabinets 178.8 Ah will be built of two parallel connected cabinets 89.4 Ah by using the battery distribution panel (40071346700) according to mounting circuit diagram.

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.11 Standard-Battery Cabinet 240 Ah




**Standard-Battery Cabinet 240 Ah (3 x 80 Ah)**

The battery cabinets 240 Ah will be built of three parallel connected cabinets 80 Ah by using the battery distribution panel (40071346701) according to mounting circuit diagram.

**Technical Data**

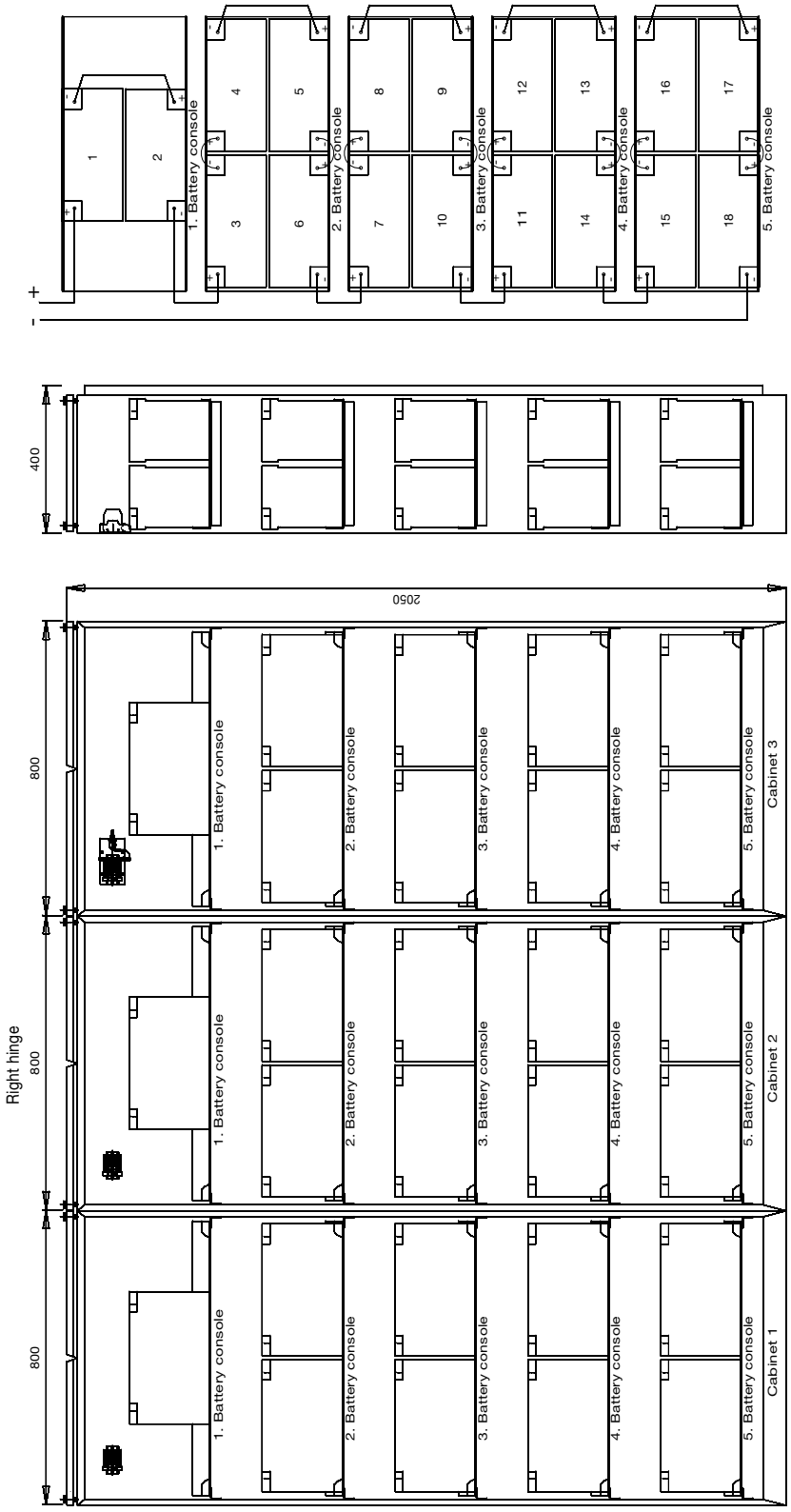
| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 80 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 54 á 12 V |
| Battery dimensions in mm (L x W x H) | 359 x 172 x 226 |
| Final pole | M8 |
| Supply terminals | max. 35 mm² |
| Weight incl. Batteries | 2070 kg |
| Dimensions in mm (W x H x D) | 3 x (800 x 2050 x 400) |
| Order no. of battery bloc | 40066070120 |

**3 x Wiring Set 4 0071 346 777 included**

| No. | Length | Number |
|---|---|---|
| 1 | 350 mm | 13 |
| 2 | 800 mm | 4 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.1.12 Standard-Battery Cabinet 268.2 Ah




**For interconnection see chapter „Circuit Diagrams“**

**Standard-Battery Cabinet 268.2 Ah (3 x 89.4 Ah)**
The battery cabinets 268.2 Ah will be built of three parallel connected cabinets 89.4 Ah by using the battery distribution panel (40071346702) according to circuit diagram.

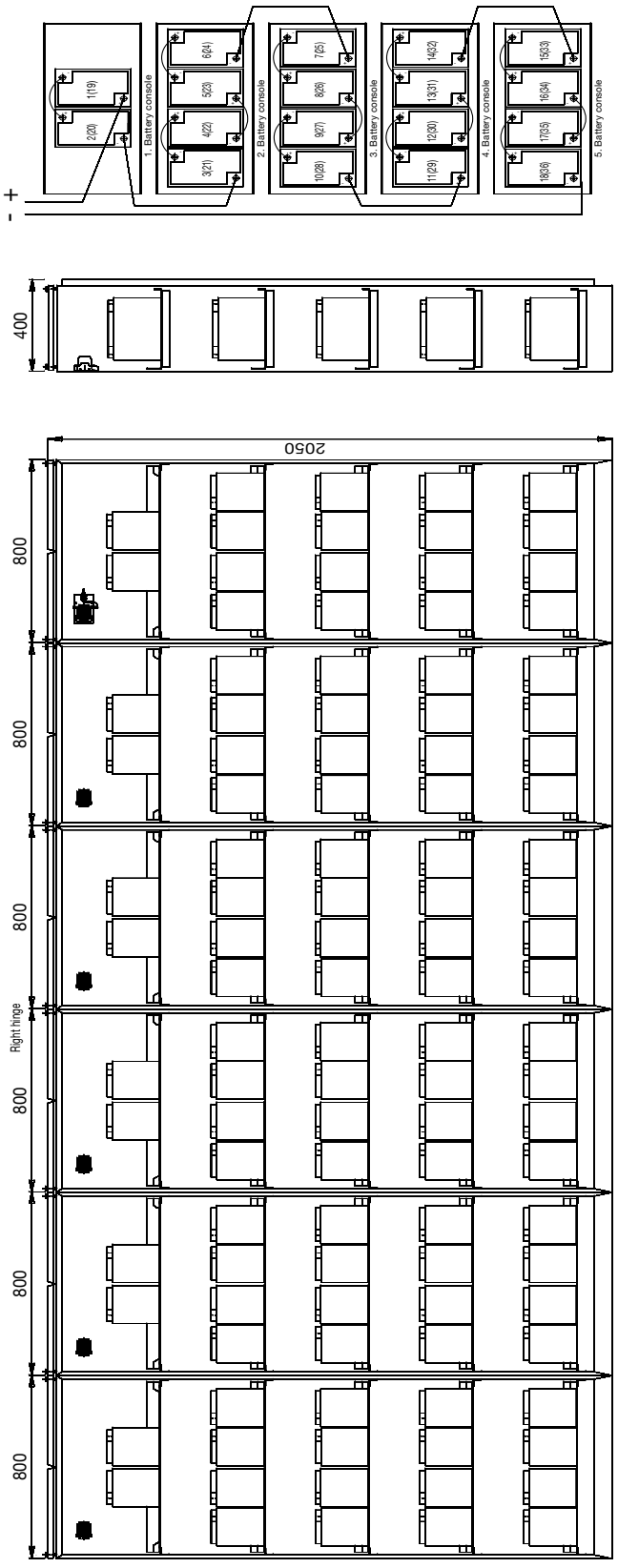
**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 89.4 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 54 á 12 V |
| Battery dimensions in mm (L x W x H) | 307.5 x 171 x 239 |
| Final pole | M6 |
| Supply terminals | max. 35 mm² |
| Weight incl. Batteries | 2250 kg |
| Dimensions mm (W x H x D) | 3 x (800 x 2050 x 400) |
| Order no. of battery bloc | 40066070821 |

**3 x Wiring Set 4 0071 360 230 included**

| No. | Length | Number |
|---|---|---|
| 1 | 350 mm | 13 |
| 2 | 800 mm | 4 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

### 3.1.14 Standard-Battery Cabinet 354 Ah




**For interconnection see chapter „Circuit Diagrams“**

**Standard-Battery Cabinet 354 Ah (3 x 118 Ah)**
The battery cabinets 354 Ah will be built of three parallel connected cabinets 118 Ah by using the battery distribution panel (40071346701) according to mounting circuit diagram.

**Technical Data**

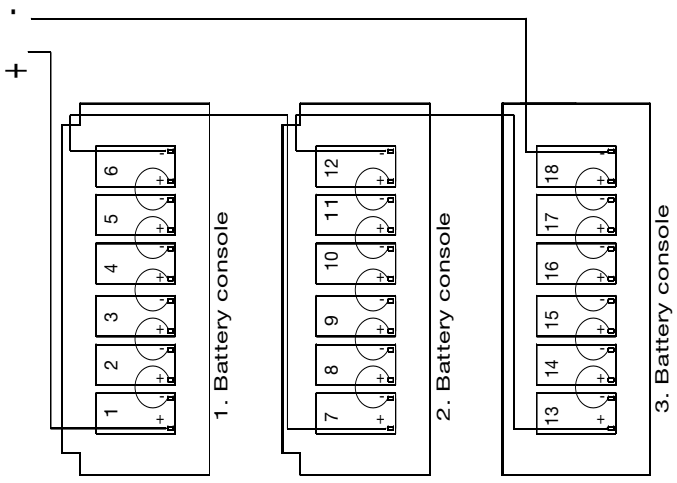
| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 6 V / 118 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 108 á 6 V |
| Battery dimensions in mm (L x W x H) | 272 x 166 x 190 |
| Final pole | M8 |
| Supply terminals | max. 35 mm² |
| Weight incl. Batteries | 3600 kg |
| Dimensions in mm (B x H x T) | 6 x (800 x 2050 x 400) |
| Order no. of battery bloc | 40066070466 |

**3 x Wiring Set 4 0071 346 775 included**

| No. | Length | Number |
|---|---|---|
| 1 | 350 mm | 26 |
| 2 | 800 mm | 8 |
| 3 | 800 mm | 2 |
| 4 | 2000 mm | 2 |

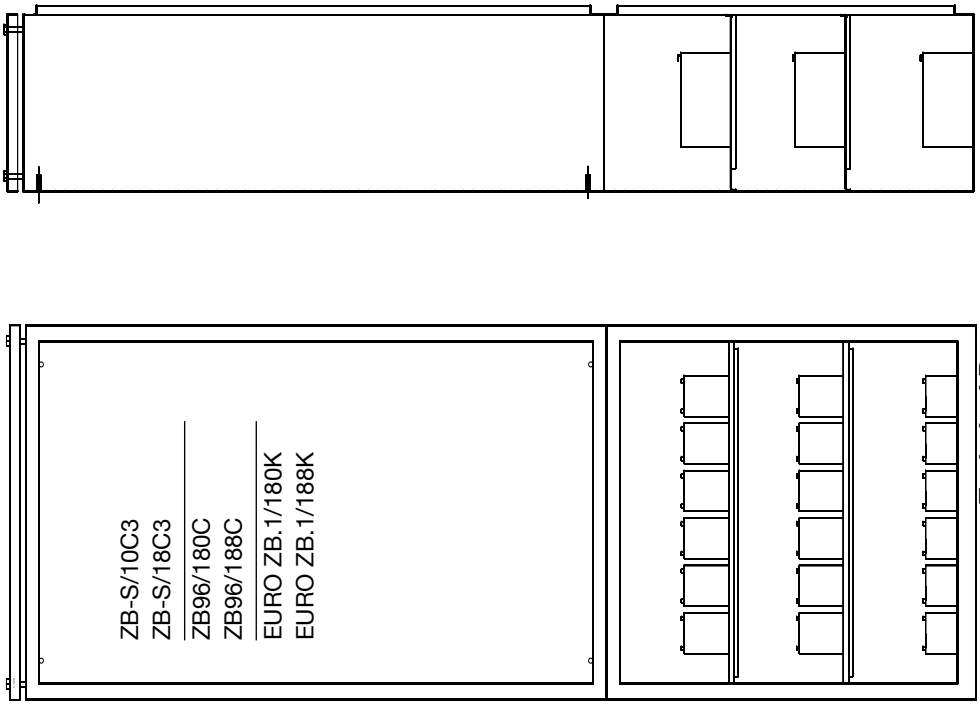
## 3.2 Compact-Battery Cabinets

### 3.2.1 Compact-Battery Cabinets 5.5 Ah




**Wiring Set 4 0071 346 005 included**

| No. | Length | Number |
|---|---|---|
| 1 | 240 mm | 15 |
| 2 | 900 mm | 2 |
| 3 | 600 mm | 1 |
| 4 | 1300 mm | 1 |



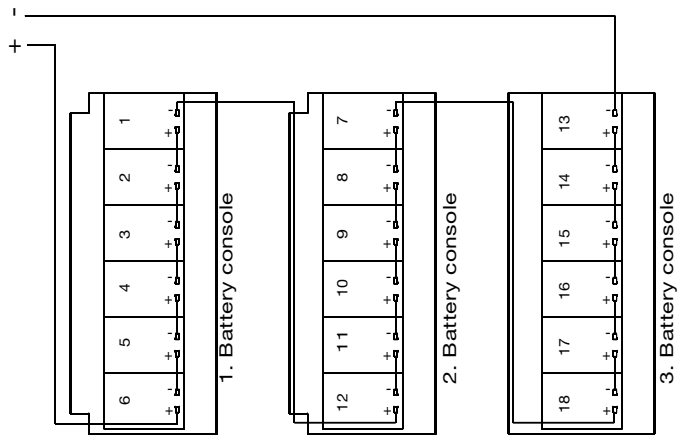
ZB-S/10C3
ZB-S/18C3
ZB96/180C
ZB96/188C
EURO ZB.1/180K
EURO ZB.1/188K

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 5.5 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 152 x 65.5 x 94.5 |
| Connectors | 6.3 mm (Faston) |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 150 kg |
| Dimensions in mm (W x H x D) | 600x 1800 x 350 |
| Order no. of batterie bloc | 40066079643 |

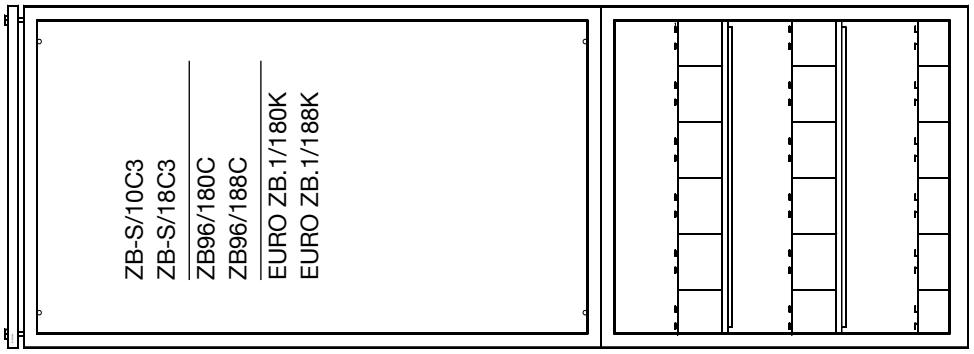
**For interconnection see chapter „Circuit Diagrams“**

### 3.2.2 Compact-Battery Cabinet 8.5 Ah




**Wiring Set 4 0071 346 005 included**

| No. | Length | Number |
|---|---|---|
| 1 | 240 mm | 15 |
| 2 | 900 mm | 2 |
| 3 | 600 mm | 1 |
| 4 | 1300 mm | 1 |

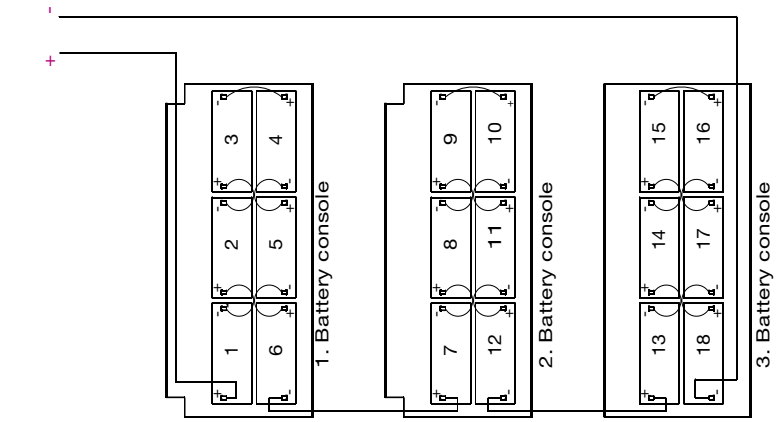



**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 8.5 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 152 x 98 x 94.5 |
| Connectors | 6.3 mm (Faston) |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. batteries | 170 kg |
| Dimensions in mm (W x H x D) | 600x 1800 x 350 |
| Order no. of battery bloc | 40066079644 |

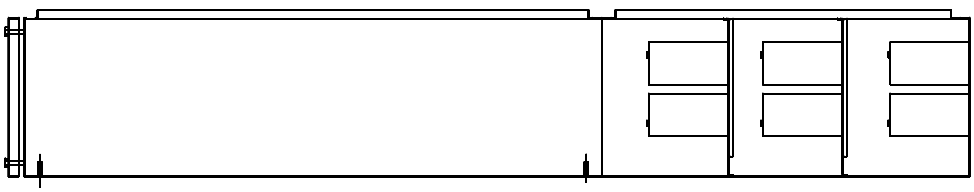
**For interconnection see chapter „Circuit Diagrams“**

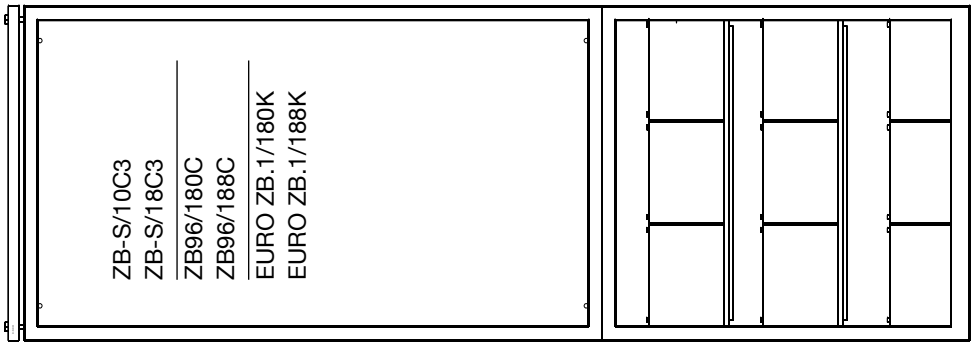
### 3.2.3 Compact-Battery Cabinet 12 Ah




**Wiring Set 400 71 346 005 included**

| No. | Length | Number |
|---|---|---|
| 1 | 240 mm | 15 |
| 2 | 900 mm | 2 |
| 3 | 600 mm | 1 |
| 4 | 1300 mm | 1 |



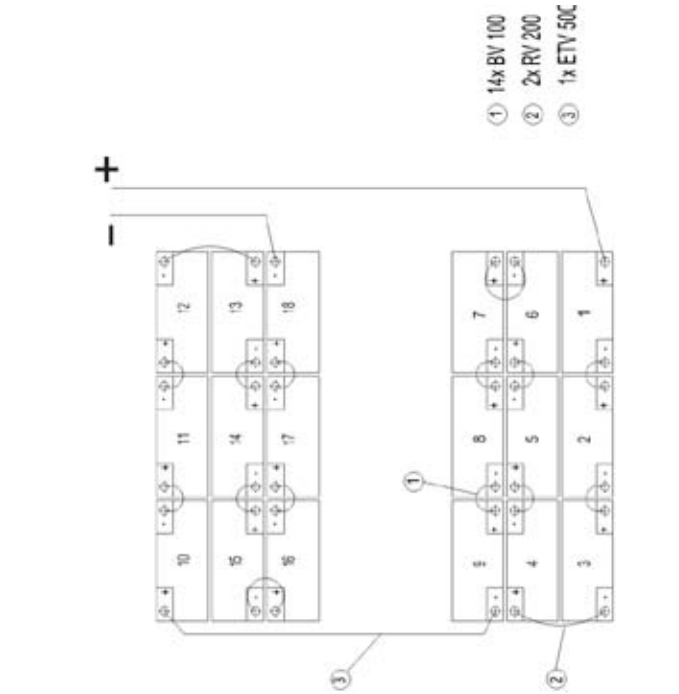


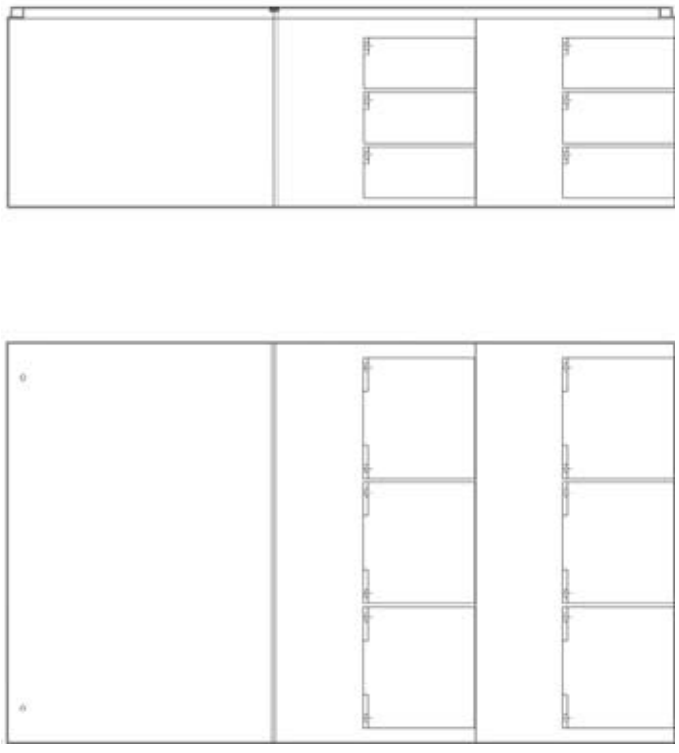

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 12 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 181 x 76 x 152 |
| Connectors | 6.3 mm (Faston) |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 205 kg |
| Dimensions in mm (W x H x D) | 600 x 1800 x 350 |
| Order no. of battery bloc | 40066079645 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.2.4 Compact-Battery Cabinet 14 Ah



**Wiring Set 400 71 360 242 included**

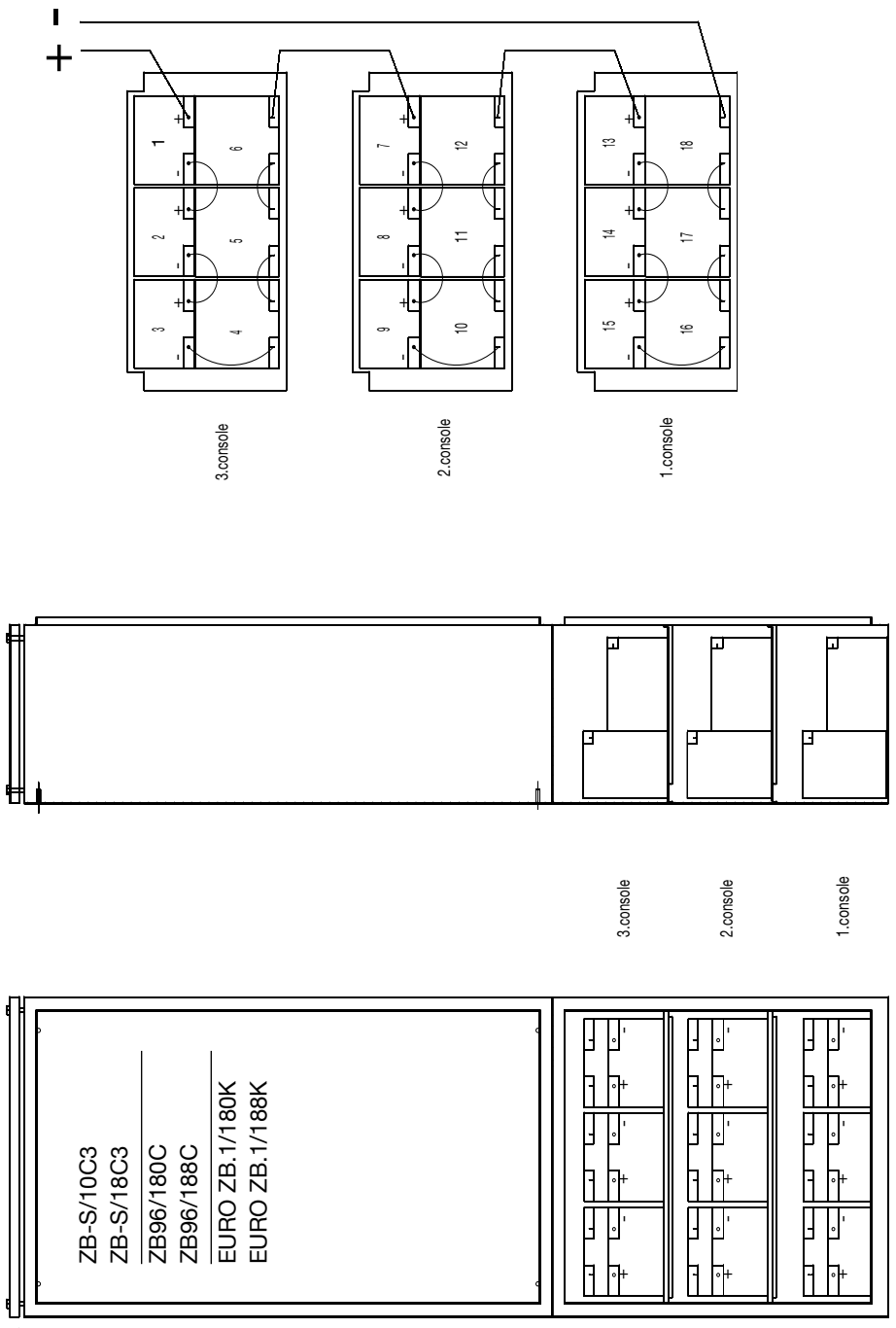
| No. | Length | Number |
|---|---|---|
| 1 | 100 mm | 14 |
| 2 | 200 mm | 2 |
| 3 | 500 mm | 1 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 14 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 181 x 76 x 167 |
| Connectors | M 6 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 220 kg |
| Dimensions in mm (W x H x D) | 600 x 1800 x 350 |
| Order no. of battery bloc | 40066070825 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.2.5 Compact-Battery Cabinet 23.3 Ah




**Technical Data**

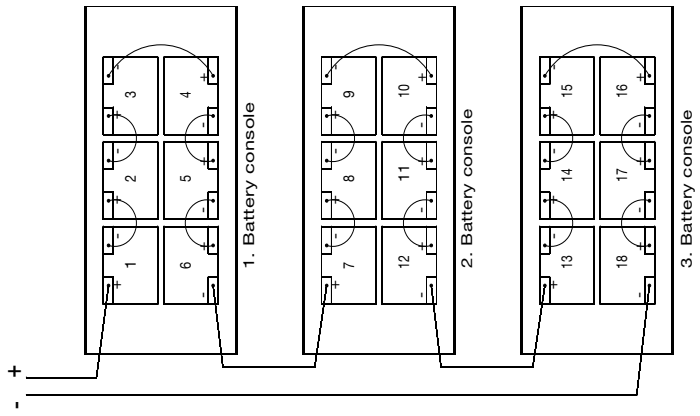
| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 23.3 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 168 x 127 x 174 |
| Final pole | M6 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 250 kg |
| Dimensions in mm (W x H x D) | 600 x 1800 x 350 |
| Order no. of battery bloc | 40066070461 |

**Wiring Set 4 0071 346 779 included**

| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 15 |
| 2 | 800 mm | 2 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

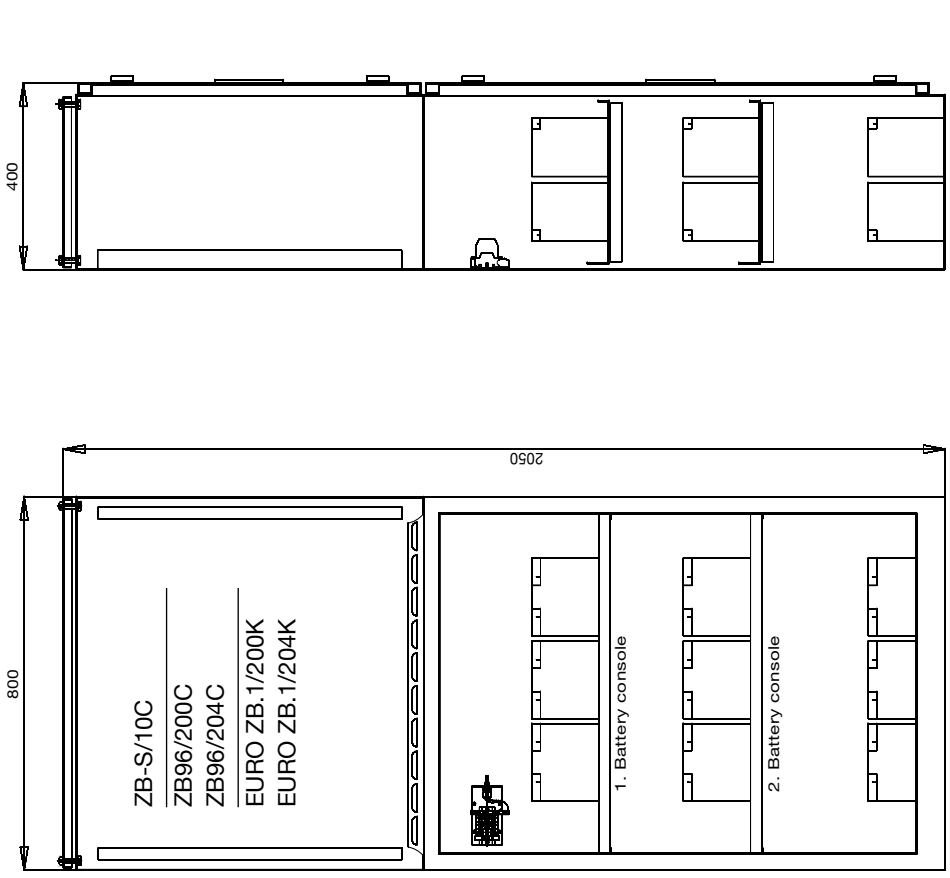
**For interconnection see chapter „Circuit Diagrams“**

### 3.2.6 Compact-Battery Cabinet 23.3 Ah




**Wiring Set 4 0071 346 779 included**

| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 15 |
| 2 | 800 mm | 2 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

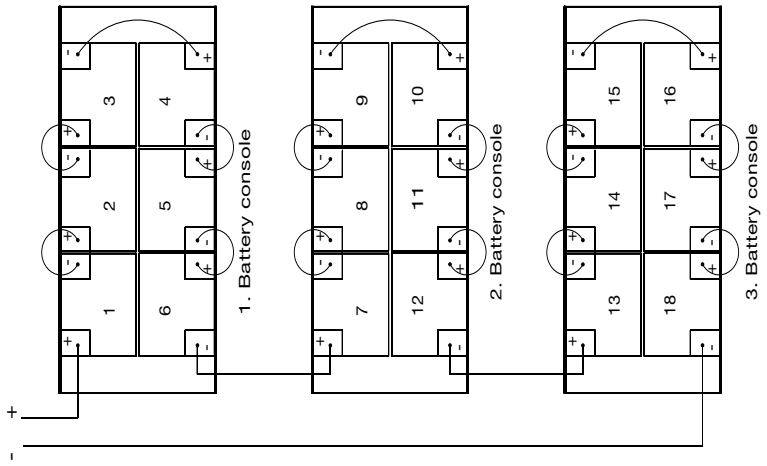



**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 23.3 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 168 x 127 x 174 |
| Final pole | M6 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. batteries | 295 kg |
| Dimensions in mm (B x H x T) | 800 x 2050 x 400 |
| Order no. of battery bloc | 40066070461 |

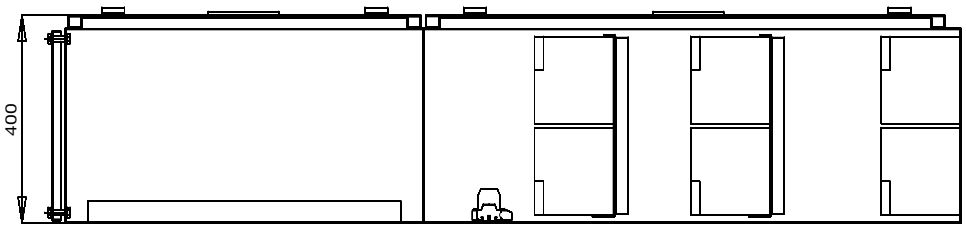
**For interconnection see chapter „Circuit Diagrams“**

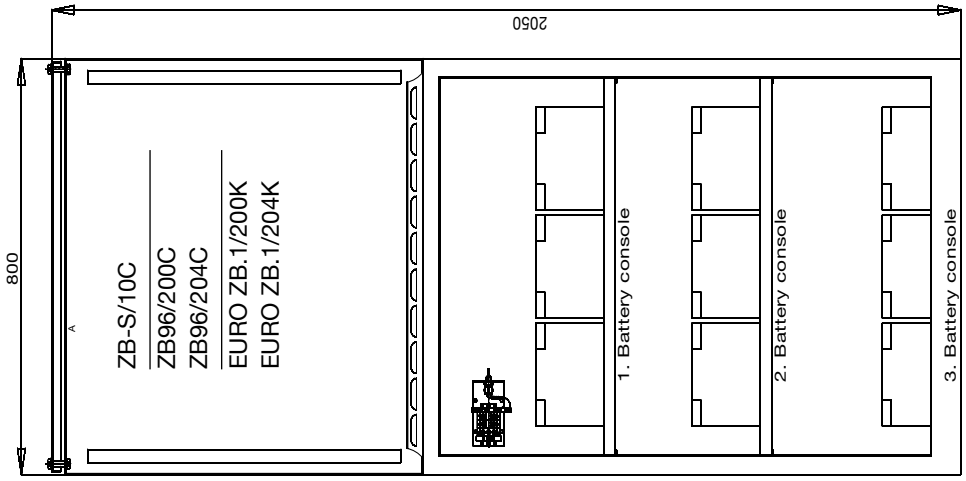
### 3.2.7 Compact-Battery Cabinet 32 Ah




**Wiring Set 4 0071 346 779 included**

| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 15 |
| 2 | 800 mm | 2 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |




**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 32 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 198 x 168 x 175 |
| Final pole | M6 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 400 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 400 |
| Order no. of battery bloc | 40066070116 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.2.8 Compact-Battery Cabinet 49.5 Ah


**Wiring Set 4 0071 346 774 included**

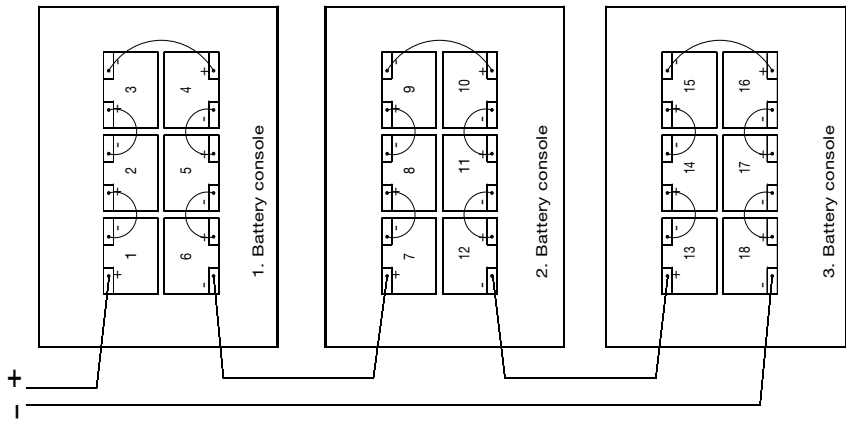
| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 12 |
| 2 | 440 mm | 3 |
| 3 | 700 mm | 2 |
| 4 | 300 mm | 1 |
| 5 | 1200 mm | 1 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 49.5 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 234 x 169 x 190 |
| Final pole | M6 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. Batteries | 465 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 400 |
| Order no. of battery bloc | 40066070463 |

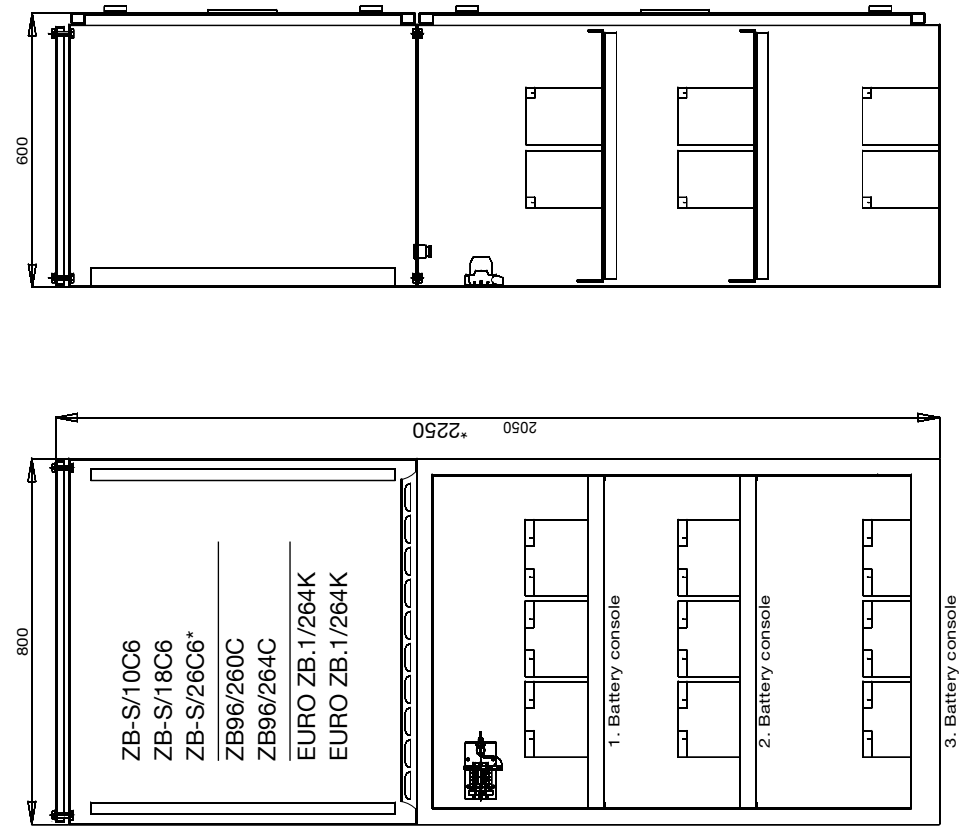
**For interconnection see chapter „Circuit Diagrams“**

### 3.2.9 Compact-Battery Cabinet 23.3 Ah




**Wiring Set 4 0071 346 779 included**

| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 15 |
| 2 | 800 mm | 2 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

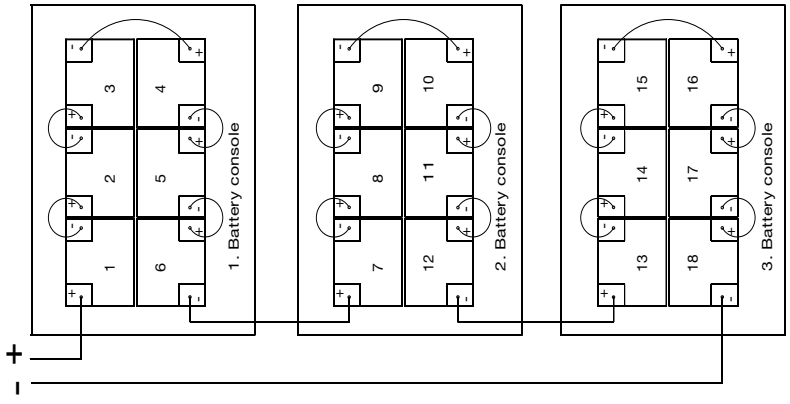


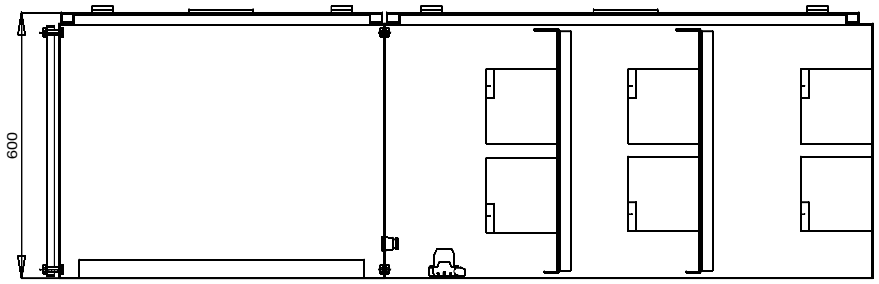

**Technical Data**

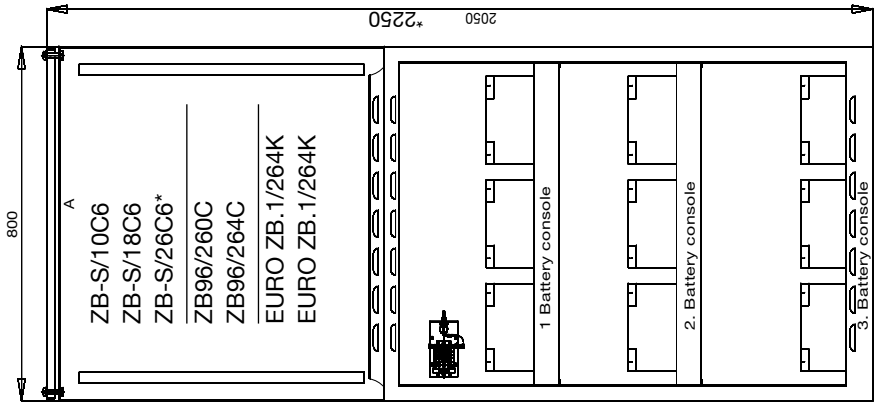
| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 23.3 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 168 x 127 x 174 |
| Final pole | M6 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. batteries | 320 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 600 |
| Order no. of battery bloc | 40066070461 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.2.10 Compact-Battery Cabinet 32 Ah




**Wiring Set 4 0071 346 779 included**

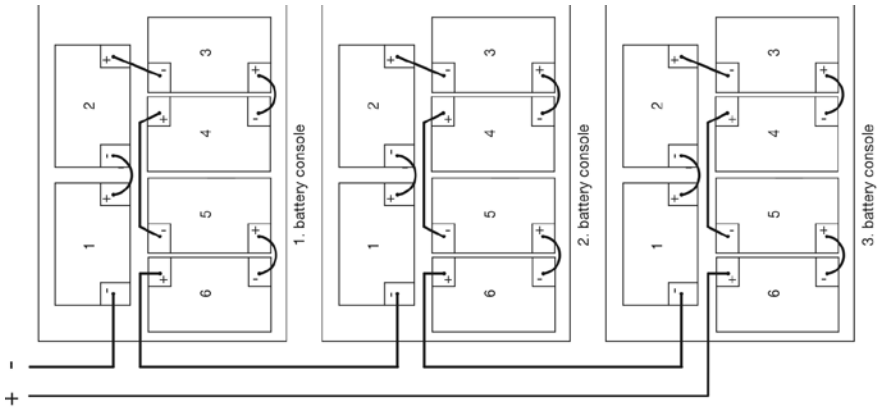
| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 15 |
| 2 | 800 mm | 2 |
| 3 | 800 mm | 1 |
| 4 | 2000 mm | 1 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 32 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x B x H) | 198 x 168 x 175 |
| Final pole | M6 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. batteries | 400 kg |
| Dimensions in mm (B x H x T) | 800 x 2050 x 600 |
| Order no. of battery bloc | 40066070116 |

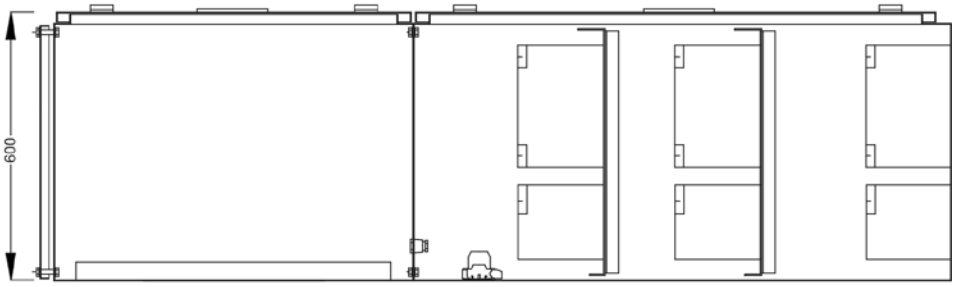
**For interconnection see chapter „Circuit Diagrams“**

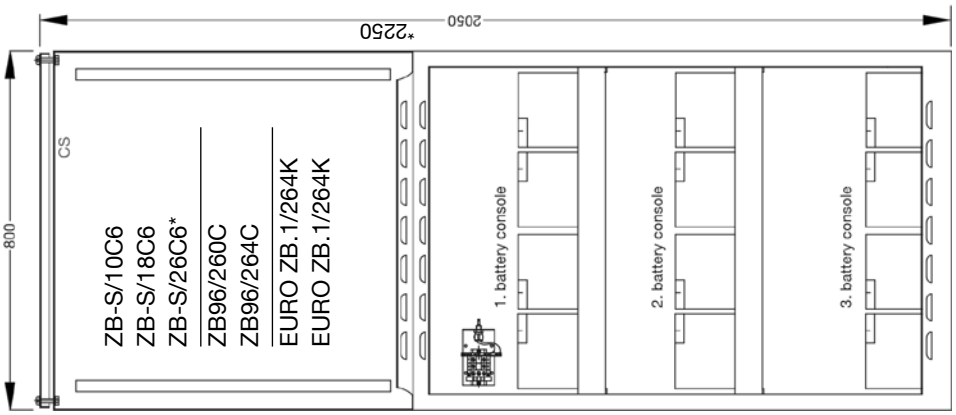
### 3.2.11 Compact-Battery Cabinet 55 Ah




**Wiring Set 4 0071 347 449 included**

| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 12 |
| 2 | 360 mm | 3 |
| 3 | 1000 mm | 2 |
| 4 | 400 mm | 1 |
| 5 | 1400 mm | 1 |



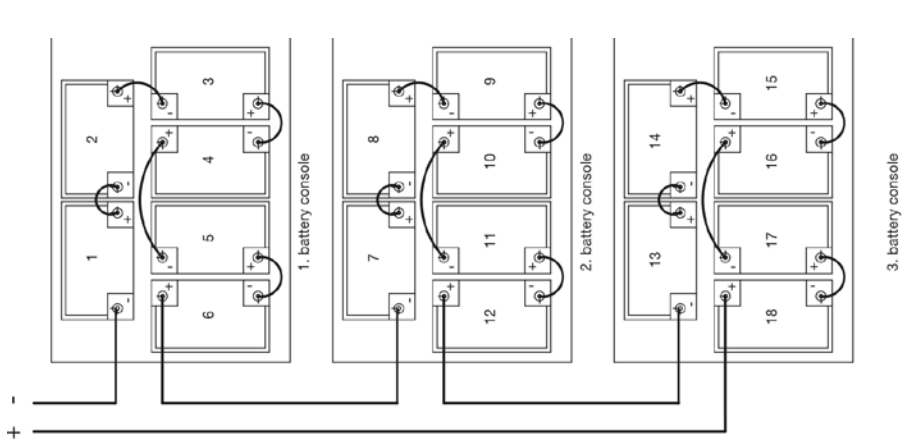



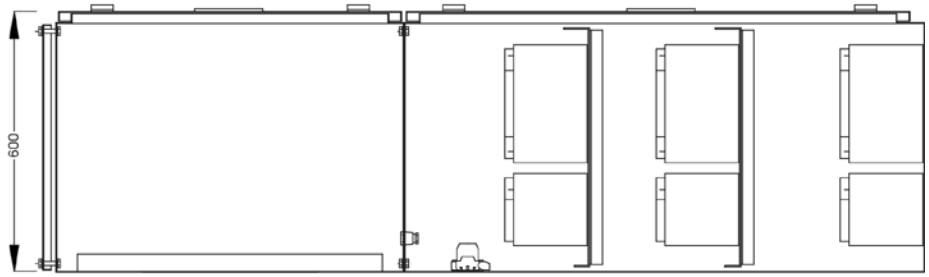

**Technical Data**

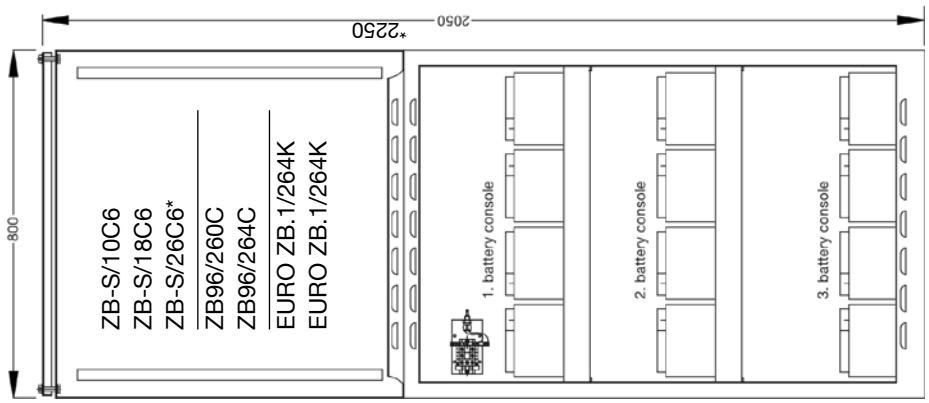
| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 55 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 272 x 166 x 190 |
| Final pole | M6 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 550 kg |
| Dimensions in mm (B x H x T) | 800 x 2050 x 600 |
| Order no. of battery bloc | 40066070118 |

**For interconnection see chapter „Circuit Diagrams“**

### 3.2.12 Compact-Battery Cabinet 59.2 Ah




**Wiring Set 4 0071 346 819 included**

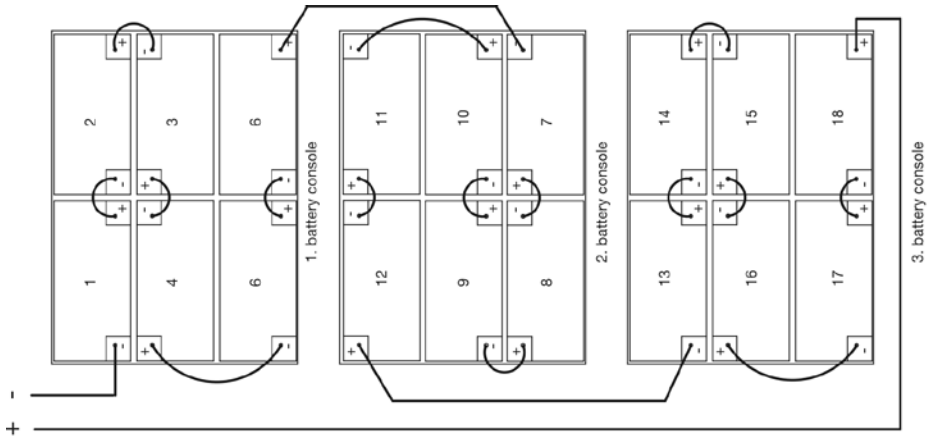
| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 12 |
| 2 | 440 mm | 3 |
| 3 | 1000 mm | 2 |
| 4 | 400 mm | 1 |
| 5 | 1400 mm | 1 |

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 59.2 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 272 x 166 x 190 |
| Final pole | M6 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 580 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 600 |
| Order no. of battery bloc | 40066070464 |

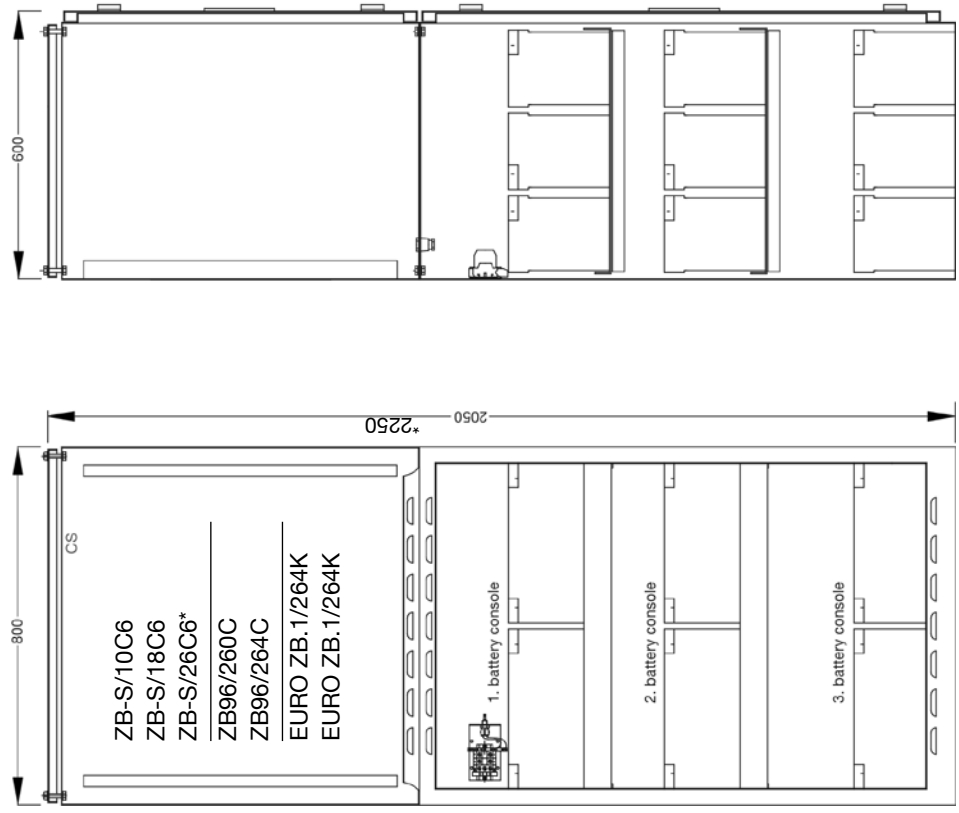
**For interconnection see chapter „Circuit Diagrams“**

### 3.2.13 Compact-Battery Cabinet 80 Ah




**Wiring Set 4 0071 346 820 included**

| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 12 |
| 2 | 360 mm | 3 |
| 3 | 1500 mm | 2 |
| 4 | 400 mm | 1 |
| 5 | 1800 mm | 1 |

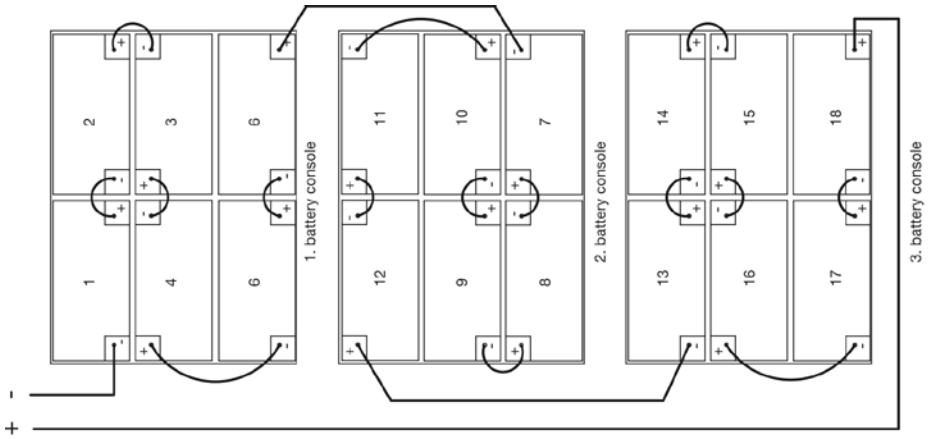



**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 80 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 359 x 172 x 226 |
| Final pole | M8 |
| Supply terminals | max. 35 mm² |
| Weight incl. batteries | 695 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 600 |
| Order no. of battery bloc | 40066070120 |

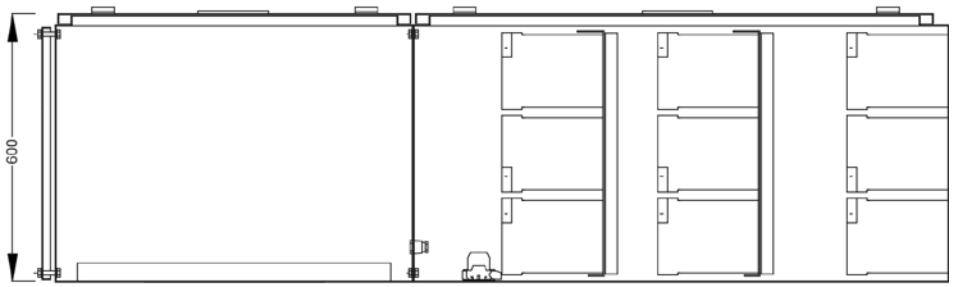
**For interconnection see chapter „Circuit Diagrams“**

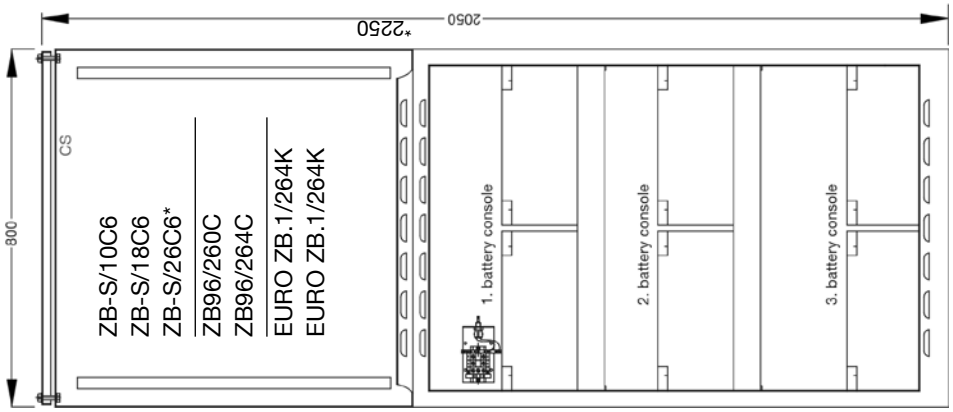
### 3.2.14 Compact-Battery Cabinets 89.4 Ah




**Wiring Set 4 0071 360 231 included**

| No. | Length | Number |
|---|---|---|
| 1 | 300 mm | 12 |
| 2 | 360 mm | 3 |
| 3 | 1500 mm | 2 |
| 4 | 400 mm | 1 |
| 5 | 1800 mm | 1 |



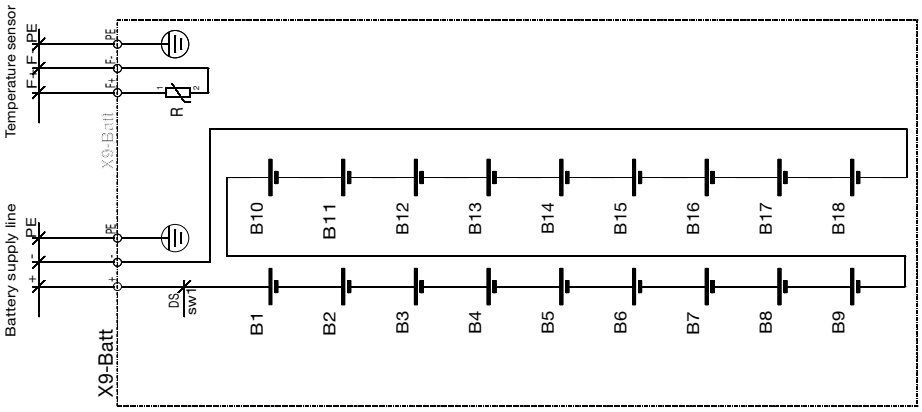

**Technical Data**

| | |
|---|---|
| Type of battery (C10; 1.8 V/Z; +20 °C) | 12 V / 89.4 Ah |
| Rated voltage of all batteries | 216 V |
| Number of all batteries | 18 á 12 V |
| Battery dimensions in mm (L x W x H) | 307.5 x 171 x 239 |
| Final pole | M6 |
| Supply terminals | max. 35 $mm^2$ |
| Weight incl. batteries | 750 kg |
| Dimensions in mm (W x H x D) | 800 x 2050 x 600 |
| Order no. of battery bloc | 40066070821 |

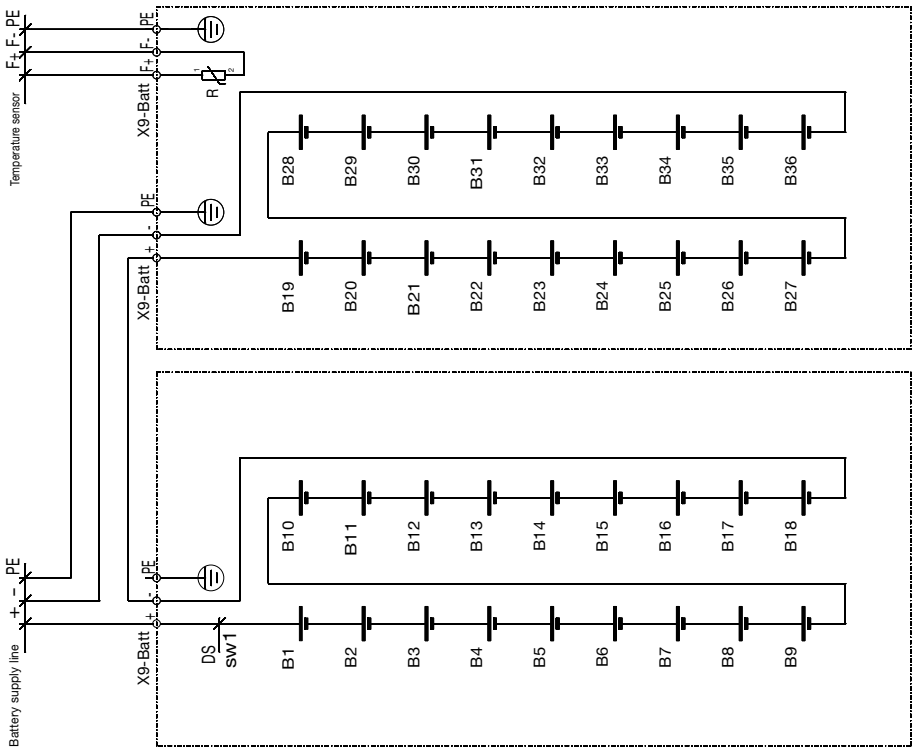
**For interconnection see chapter „Circuit Diagrams“**

# 4 Circuit Diagrams

## 4.1 Wiring 5.5 Ah to 89.4 Ah

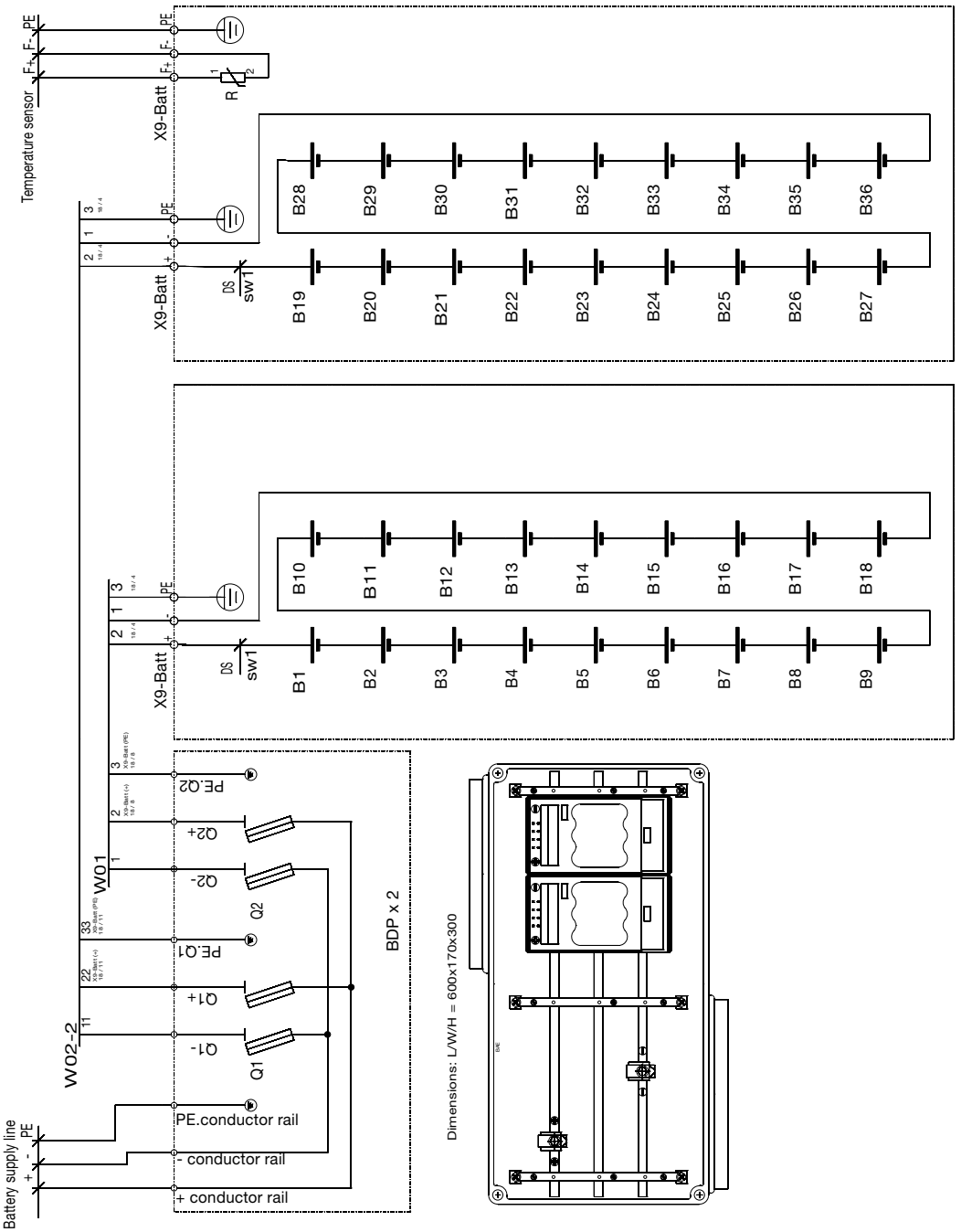



## 4.2 Wiring 118 Ah




**Important Note!**
**Only one temperature sensor per charger has to be installed.**
**A series- or parallel connection of the temperature sensor can cause an improper charging of the battery.**

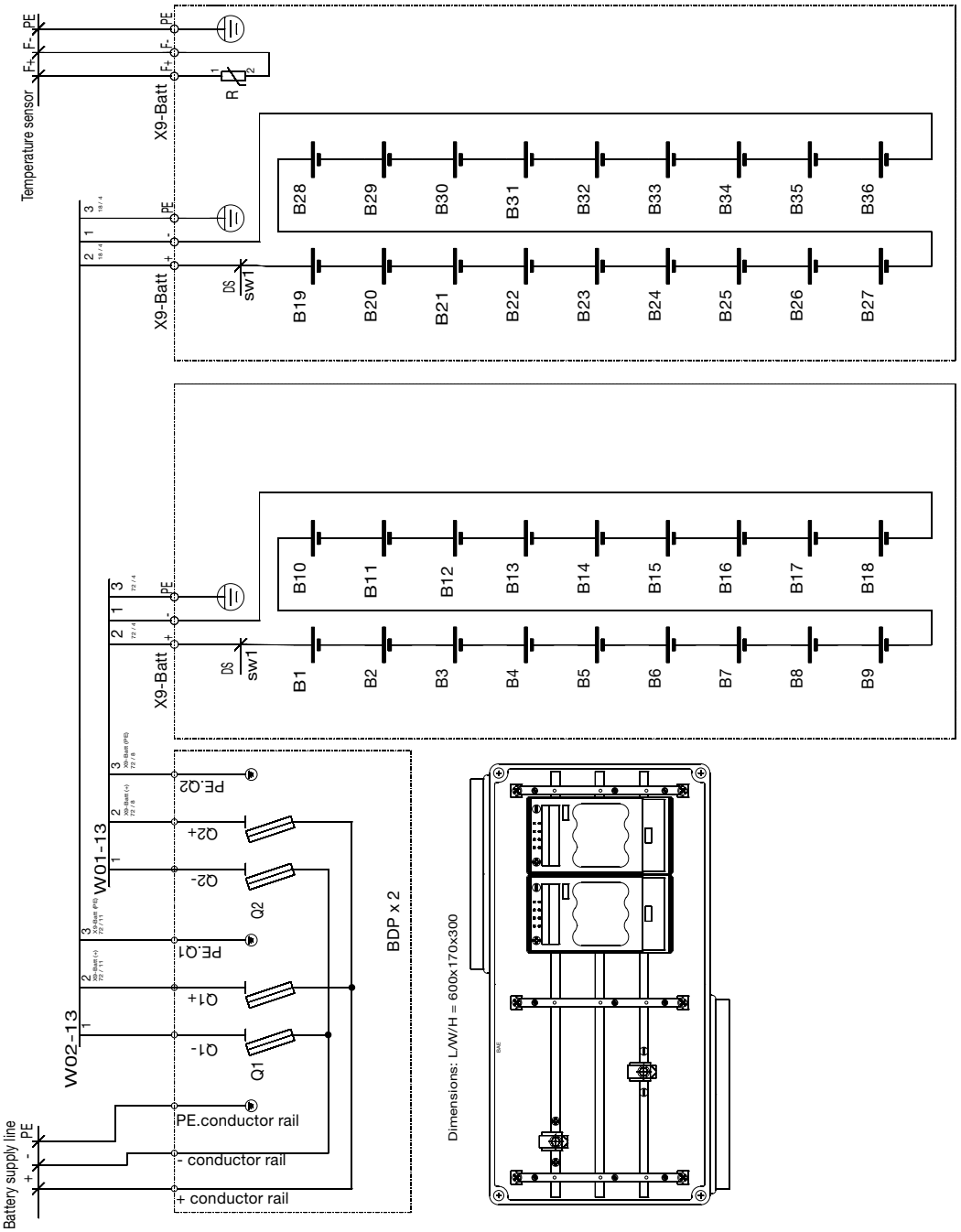
## 4.3 Wiring 160 Ah




**Important Note!**
**Only one temperature sensor per charger has to be installed.**
**A series- or parallel connection of the temperature sensor can cause an improper charging of the battery.**

**Battery Distribution Panel**
see separate installation instruction 30080001443

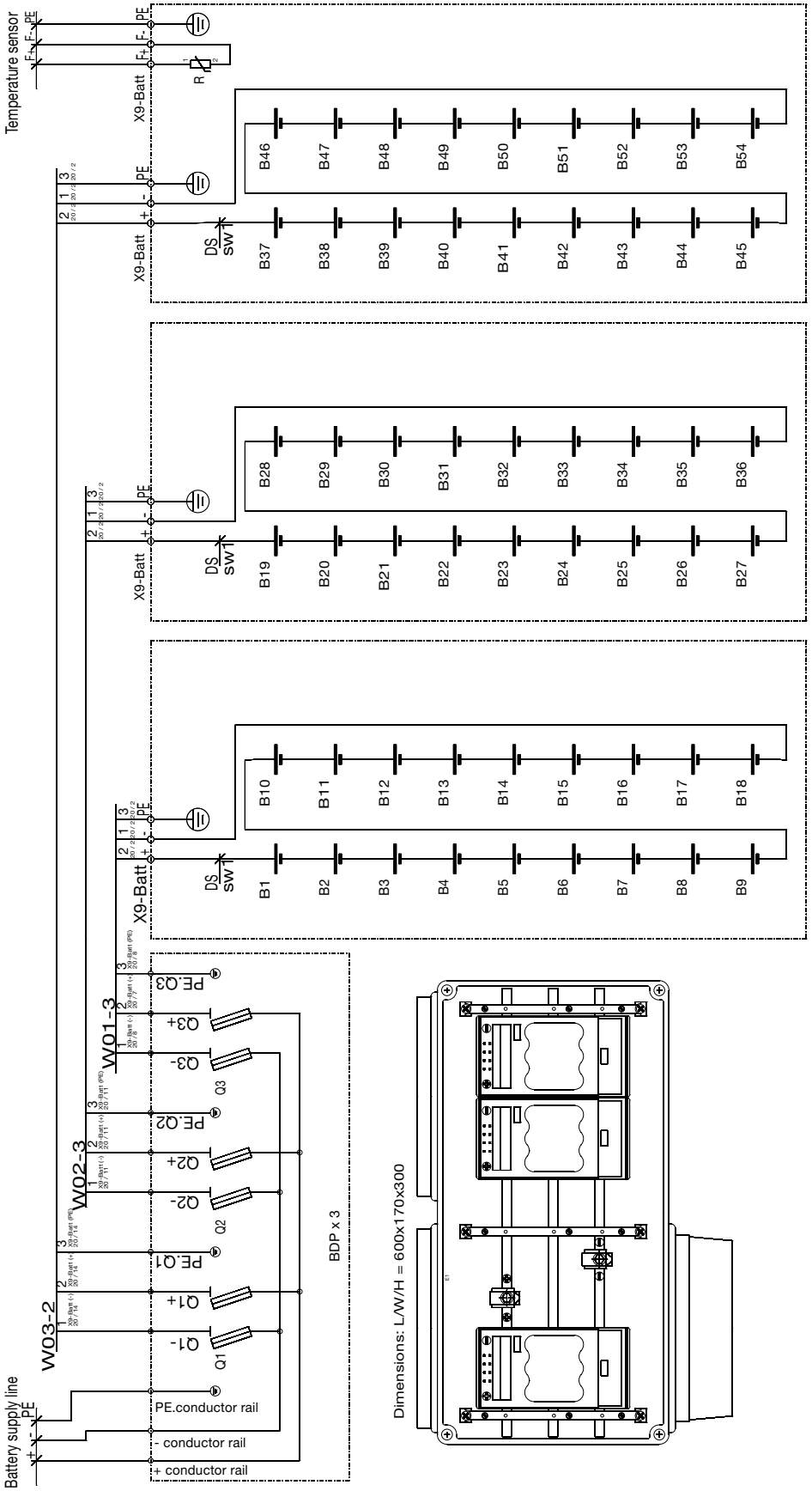
## 4.4 Wiring 178.8 Ah




**Important Note!**
**Only one temperature sensor per charger has to be installed.**
**A series- or parallel connection of the temperature sensor can cause an improper charging of the battery.**

**Battery Distribution Panel**
see separate installation instruction 30080001443

## 4.5 Wiring 240 Ah



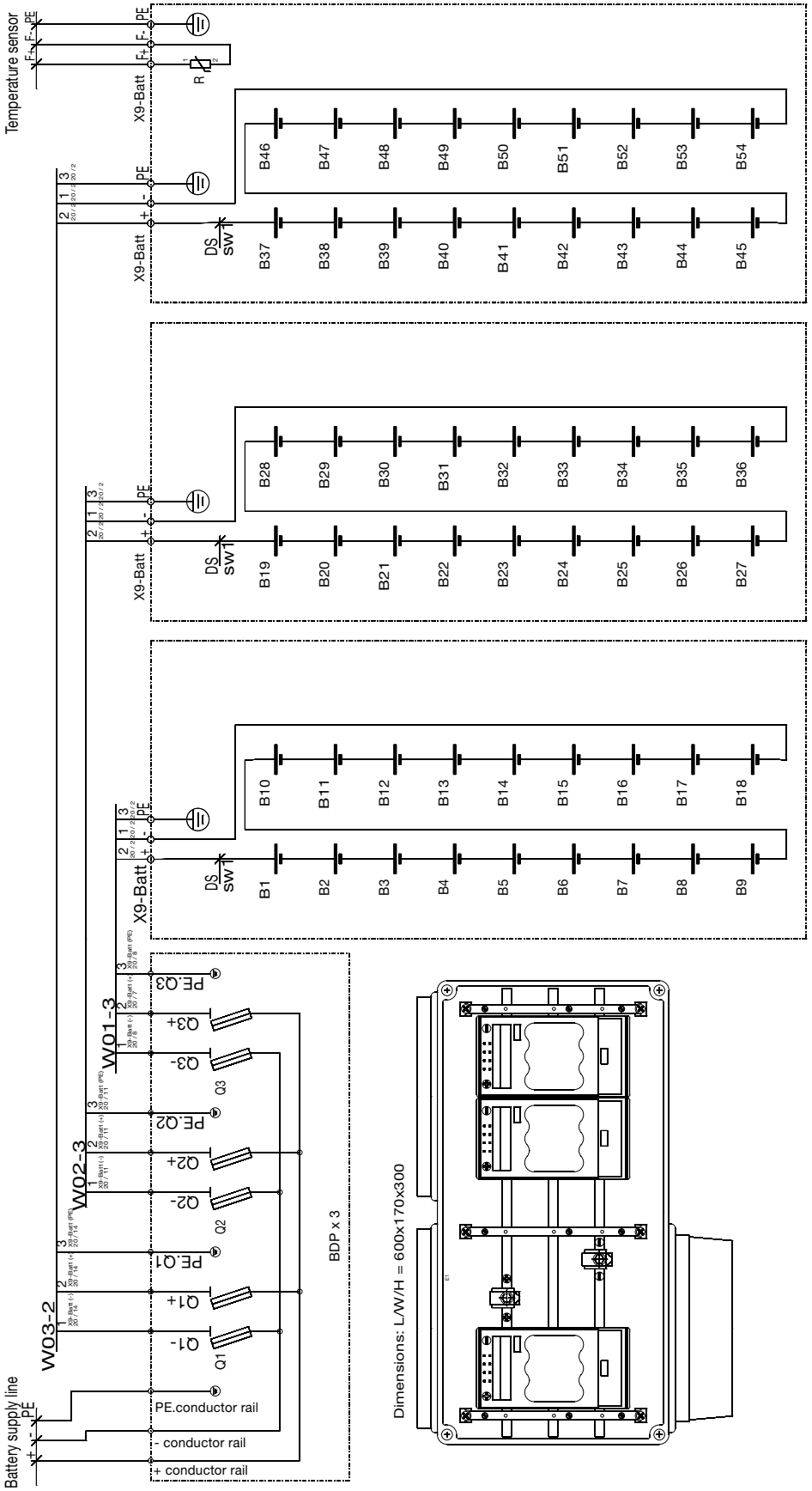




**Important Note!**
**Only one temperature sensor per charger has to be installed.**
**A series- or parallel connection of the temperature sensor can cause an improper charging of the battery.**

**Battery Distribution Panel**
see separate installation instruction 300800001443

## 4.6 Wiring 268.2 Ah



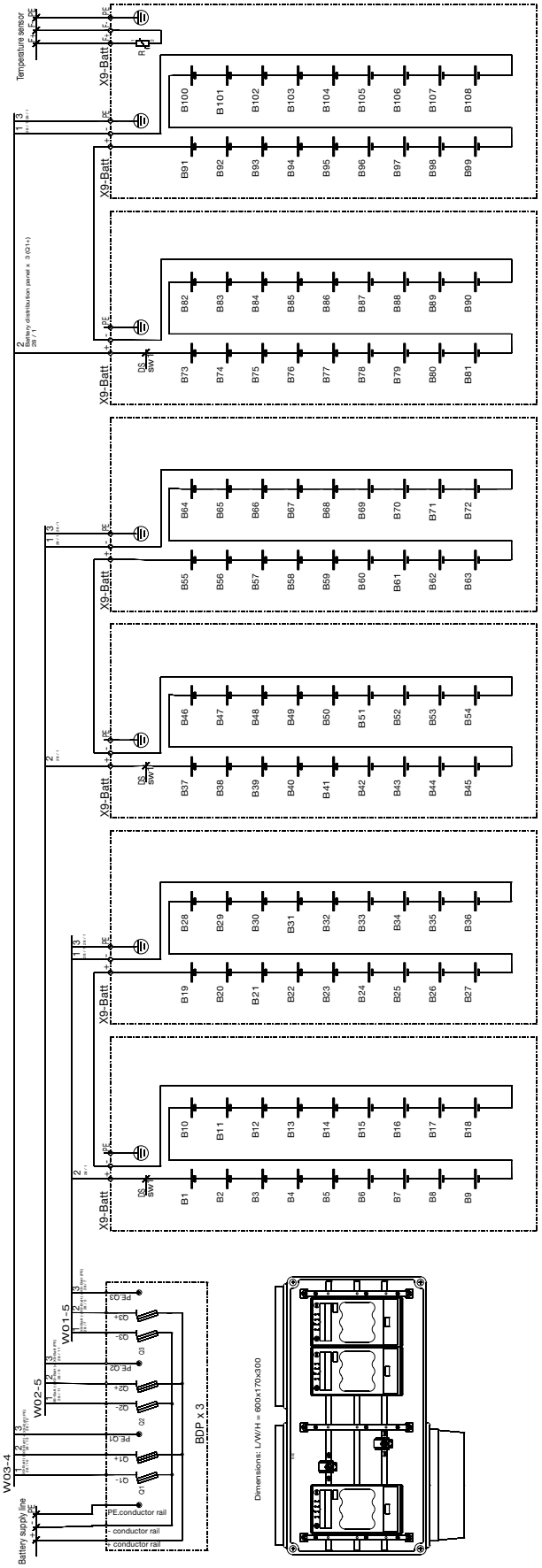




**Important Note!**
**Only one temperature sensor per charger has to be installed.**
**A series- or parallel connection of the temperature sensor can cause an improper charging of the battery.**

**Battery Distribution Panel**
see separate installation instruction 300800001443

## 4.7 Wiring 354 Ah




**Important Note!**
**Only one temperature sensor per charger has to be installed.**
**A series- or parallel connection of the temperature sensor can cause an improper charging of the battery.**

**Battery Distribution Panel**
see separate installation instruction 300800014 43

# 5 Transport, Packaging and Storage

## 5.1 Safety Notes

**⚠ WARNING! Risk of Injury!**
**There is a risk of injury when transporting or loading due to falling parts.**

**! ATTENTION! Damage to Property!**
**Batteries will be destroyed or damaged by improper transport.**

The following safety notes have to be observed:
- Never lift loads over person`s head.
- Always move battery with great care and attention.
- Only use lifting accessories and hoisting devices with enough loading capacity.

## 5.2 Carriage by land of closed lead acid batteries

Monoblocs have to be transported standing upright.

Batteries with no damage do not have to be transported as hazardous material (In Germany according to ”Hazardous Material Regulation for Street –ADR- and for Train –RID-“).

They have to be protected against short circuits, slipping, falling and damage.

Blocs can be stockpiled adequately by securing on the pallets (ADR or RID). It is forbidden to stack one pallet above the other.

Blocs with leaky or damaged containers have to be packed and transported as hazardous material of class 8, UN-no. 2794.

## 5.3 Carriage by sea of closed lead acid batteries

The following type series are not hazardous material according to IMDG, because they fulfill the IATA-clause A 67:

Sonnenschein A 400

Marathon

Sprinter

## 5.4 Carriage by air of closed lead acid batteries

The following type series are not hazardous material according to IATA-clause A67:
Sonnenschein A400
Marathon
Sprinter

## 5.5 Abbreviations

| | |
|---|---|
| ADR: | The European Agreement Concerning the International Carriage of Dangerous Goods by Road (covering most of Europe) |
| RID: | Regulations concerning the International Carriage of Dangerous Goods by Rail (covering most of Europe, parts of North Africa and the Middle East) |
| IMDG: | The International Maritime Dangerous Goods Code |
| IATA: | The International Air Transportation Association (worldwide) |
| ICAO: | Civil Aviation Organization’s Technical Instructions for the Safe Transport of Dangerous Goods by Air |

## 5.6 Transport Inspection

Check delivery on receipt for completeness and for transport damages, immediately.

If external damage is detected do not accept the delivery, except under protest.

## 5.7 Packaging

If no return – agreement exists for packing material separate it according to type and size for further use.

**ATTENTION!**
**Packing material has to be recycled in an environmentally friendly way and according to the local provisions governing disposal. If necessary, commission special recycling company.**

- Components will be identified on the basis of number and type of blocs or on the basis of a battery drawing.
- It is forbidden to stack one pallet above another.
- Observe notes for handling printed on the packing material.
- Avoid damage during transport for breakable products by marking them.

## 5.8 Requirements and Preconditions

Avoid and remove dirt and dust on the surfaces.

The storage location should fulfill the following functions:

- Shelter the cells / monoblocs from harsh weather and risk of flooding.
- Protect the batteries against any overheating risk induced by direct or indirect exposure to sun radiation.
- Storage rooms for batteries should be clean, dry, frost-free and neat.
- Protect the batteries from any risk of electric shock resulting from shortcircuiting by metallic items or conductive dust.
- Avoid any risk caused by dropping objects onto cell / monoblocs or by dropping the cell / monobloc itself.

## 5.9 Storage Conditions

- The temperature has an impact on the self - discharge rate (see fig. 1 and 2).
- Storage on a pallet wrapped in plastic material is authorised. It is not recommended however in rooms where the temperature fluctuates significantly, or if high relative humidity can cause condensation under the plastic cover. With time, this condensation can cause a whitish hydration on the poles and lead to high self-discharge by leakage current.
- It is forbidden to stack one pallet above the other
- Avoid storing unpacked cells / monoblocs on sharp-edged supports.
- It is recommended to have the same storage conditions within a batch, pallet or room.

## 5.10 Storage

Keep packages closed up to mounting and observe the external marked arrangement and storage notes. Store packages under the following conditions:

– Not to be stored outside

– Keep dry and dust-free

In the interests of users the time of storage should be as short as possible.

## 5.11 Time of Storage

The maximum time of storage is 12 months with temperatures of 20°C. Higher temperatures cause a higher self - discharge and shorten the intervals between the chargings.

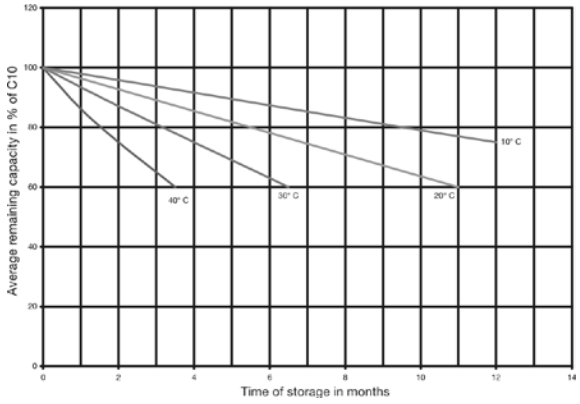



Fig. 1: Sprinter – remaining capacity in % of C10 versus time of storage with different temperatures

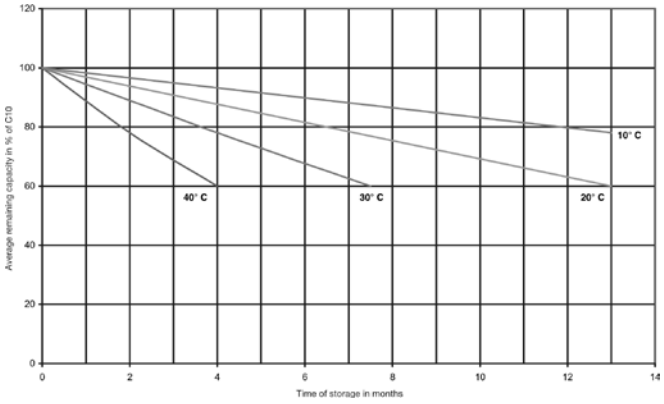



Fig. 2: Marathon – remaining capacity in % of C10 versus time of storage with different temperatures

## 5.12 Measures during Storage

- Appropriate inventory turnover based on FIFO - method ("First In- First Out") will result in a higher operating quality of the products.
- If the battery casings must be cleaned (prior to their installation) never use solvents or abrasives. Use water (wet cloth) without additives.
- For extended storage periods it is recommended to check the „open-circuit" voltage at the following intervals:
  – storage at 20°C: after a storage period of 6 months, then every 3 months afterwards.
  – storage at 30°C: after a storage period of 4 months, then every 2 months afterwards.

When measured „open circuit" voltage is < 2,11 V/C, battery has to be recharged.

Trickle charging*) should be considered necessary when the measured open circuit voltage (OCV) is < 2,11 V/C.

*)Trickle charging means continuous charge at a low rate, approximately equivalent to the internal losses of the battery and suitable to maintain the battery in a fully charged state. It can be carried out either by IU-charging (=float charging) or I-charging (constant charging) with limited current.

- Trickle charging mode durging storage

**Constant charging (IU-charging)**

| Temperature | Max. voltage per cell | Min. voltage per cell | Max. current | Charging time at max. voltage |
|---|---|---|---|---|
| 20 °C | 2,38 V | 2,27 V | 0,2 $C_{10}$ | 24 h |
| 25 °C | 2,35 V | 2,25 V | 0,2 $C_{10}$ | 24 h |
| 30 °C | 2,32 V | 2,22 V | 0,2 $C_{10}$ | 24 h |

chart 1: Value for constant voltage charging (Marathon L)

| Temperature | Max. voltage per cell | Min. voltage per cell | Max. current | Charging time at max. voltage |
|---|---|---|---|---|
| 20 °C | 2,40 V | 2,29 V | 0,2 $C_{10}$ | 24 h |
| 25 °C | 2,37 V | 2,27 V | 0,2 $C_{10}$ | 24 h |
| 30 °C | 2,35 V | 2,25 V | 0,2 $C_{10}$ | 24 h |

chart 2: Value for constant voltage charging (Sprinter)

Depending on the chargers the charging time shall be extended by 24 hours for every 0,04V less than the maximum voltage, in which the „minimum voltage" is still the lower limit.

For temperatures < 15 °C it is recommended to charge the battery 20 hours.

# 6 Installation

## 6.1 Safety Notes

**⚠ WARNING! Risk of Injury!**
**Improper mounting and installation can cause serious personal injury and / or material damage. This work must only be performed by authorised, skilled and adequate personnel who have received instructions providing information on the device and in observance of the local safety regulations.**

- Ensure there is enough free moving space.
- Ensure orderliness and cleanliness at the working place. Loose tools lying arround are dangerous!

## 6.2 Battery rooms, Ventilation and General requirements

General: This is a guideline only and consists of abridgements from national and international standards and guidelines.
See EN 50272-2 for further information. Also, observe “Operating Instructions” and “Installation Instructions”.

### 6.2.1 Temperature

- AGM-batteries are developed to be operated within a wide temperature range -15°C and +55°C.
- The battery-room temperature should be between +10°C and +30°C.
- The optimum operating temperature is the nominal temperature of 20°C.
- Higher temperatures reduce the lifetime. Above 40°C there is a risk of „thermal runaway effects“.
- Lower temperatures reduce the available capacity and prolong the recharge time.
- Below approx. -8°C there is a risk of freezing, depending on the depth of discharge. On the other hand it is possible to use the batteries at lower temperatures, under specific conditions.
- The battery temperature effects the available capacity.
- The difference of temperature between the cells / monoblocs in one battery-line has to be under 5 °C (5 Kelvin).

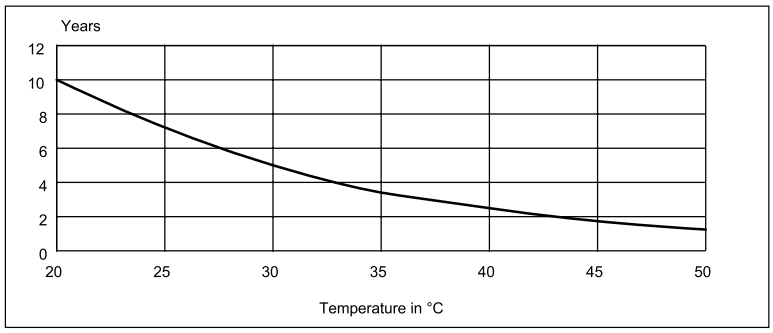



Fig. 1: Sprinter – Life utility versus temperature

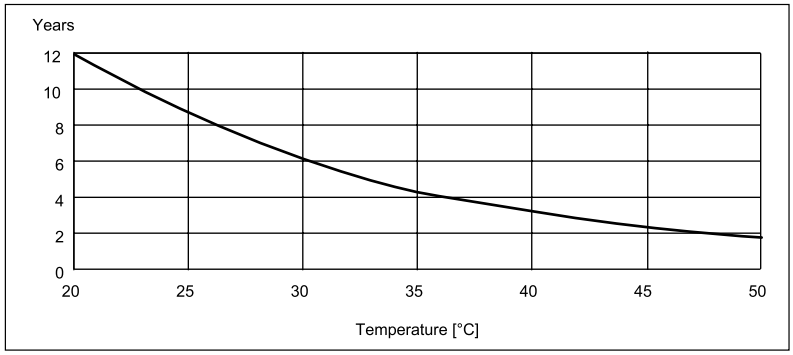



Fig. 2: Marathon – Life utility versus temperature

### 6.2.2 Room dimensions and Surface conditions

Floors shall be reasonably level and able to support the battery weight.

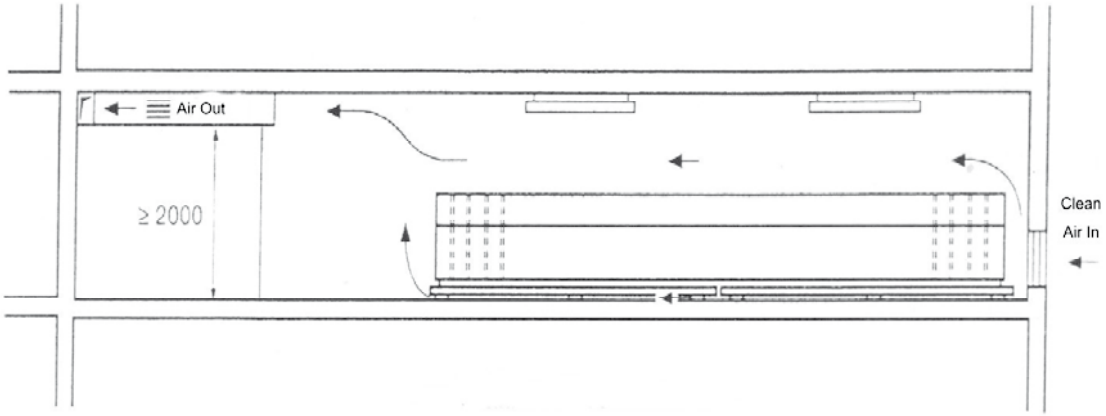
From EN 50272-2: "...The floor area for a person standing within arm´s reach of the battery shall be electrostatic dissipative in order to prevent electrostatic charge generation. The resistance to a groundable point measured to IEC 61340-4-1 shall be less than 10 MOhm.

Conversely the floor must offer sufficient resistance R for personnel safety.
Therefore the resistance of the floor to a groundable point when measured in accordance with IEC 61340-4-1 shall be:

- for battery nominal voltage 500 V: 50 kOhm R 10 MOhm and
- for battery nominal voltage > 500 V: 100 kOhm R 10 MOhm

Note 1:
To make the first part of the requirement effective, personnel shall wear anti-static footwear when carrying out maintenance work on the battery. The footwear shall comply with EN 345.

Note 2:
Arm´s reach: 1.25 m distance (Definition of arm´s reach see HD 384.4.41.)..."
Room inlets and outlets: The layout for air circulation should be as shown below:




### 6.2.3 Ventilation

Battery rooms must be vented acc. to EN 50 272-2 in order to dilute gas (hydrogen and oxygen) released by charging and discharging and to avoid explosions. Therefore, the electrical installation must not be "EX" protected. It must be designed for wet room conditions.

Do not install batteries in airtight enclosures.

Spark generating parts must have a safety distance to cell or bloc openings (valves at closed batteries) as specified in EN 50272-2.

Heaters with naked flames or glowing parts or devices are forbidden. Heater temperature must not exceed 300°C.

### 6.2.3.1 Ventilation requirements

**Ventilation of electrical rooms**

Dimensions of ventilation acc. to EN 50272-2.

The minimum air flow rate for ventilation of a battery location or compartment shall be calculated by the following formula:

**$Q = 0.05 \times n \times I_{gas} \times CN \times 10^{-3}$ [m³/h]**

Q = needed air volume flow in m³/h
0.05 = fixed factor
n = no. of accumulator cells
Igas = current in mA per Ah, fits 8 mA per Ah for Iboost with VRLA batteries
CN = capacity C10 for lead acid at 20 °C

Example for needed air volume flow of ZB-S with 160 Ah lead acid battery:

$Q = 0.05 \times n \times I_{gas} \times CN \times 10^{-3}$
$Q = 0.05 \times 108 \times 8 \times 160 \times 10^{-3}$ m³/h
**Q = 6.912 m³/h**

In order to ensure the air volume flow of 6.912 m³/h, the air inlets and outlets in the electrical distribution room must have the following min. cross-sections acc. to EN 50272-2.

Vent cross-section of the air inlets and outlets:
A ● 28 x Q
A ● 28 x 6.912 m³/h
**A ● 193.54 cm²**

The required vents in the F90 walls must be guarded by fire protection measures, e.g. F90 fire shutters.
As the calculation shows, the use of even the largest battery does not require an elaborate technical ventilation (e.g. explosion protected fans).
Due to the installed maintenance-free, sealed lead acid gas recombination batteries no further special constructional requirements such as a floor resistant to electrolytes or a floor covering (tiles) etc. have to be met.
**VRLA valve regulated lead acid monobloc batteries can operate in any position. Except on top.**

**Calculation of ventilation of electrical rooms acc. EN 50272-2 (calculated for boost charge!):**

**Chart 9**

| Battery 216 V (when 1.8V/Z and +20°C) | 5.5 | 8.5 | 12 | 14 | 23.3 | 32 | 49.5 | 55 | 59.2 | 80 | 89.4 | 118 | 160 | 178.8 | 240 | 268.2 | 354 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Air volume flow req. for the ventilation of the place of installation [m³/h] | 0.24 | 0.37 | 0.52 | 0.60 | 1.01 | 1.36 | 2.14 | 2.38 | 2.56 | 3.46 | 3.86 | 5.1 | 6.91 | 7.72 | 10.37 | 11.59 | 15.29 |
| Vent cross-section of the air inlets and outlets of the place of installation [cm² about 0.1 m/s air flow | 6.65 | 10.28 | 14.52 | 16.93 | 28.18 | 38.7 | 59.88 | 66.53 | 71.61 | 96.77 | 108.14 | 142.73 | 193.54 | 216.28 | 290.3 | 324.41 | 428.2 |

#### 6.2.3.2 Close vicinity of the battery

From EN 50272-2: "…In the close vicinity of the battery the dilution of explosive gases is not always secured. Therefore a safety distance extending through air must be observed within which sparking or glowing devices (max. surface temperature 300°C) are prohibited. The dispersion of explosive gas depends on the gas release rate and the ventilation close to the source of release.

### 6.2.4 Electrical requirements (protection, insulation, resistance, etc.)

To prevent a build-up of static electricity when handling batteries, clothing/materials, safety boots and gloves are required to have a surface resistance $10^8$ Ohm and an insulation resistance of $10^5$ Ohm.

From EN 50272-2: "…To be resistant against environmental influences, like temperature, wetness, dust, gases, vapours and mechanical loads, the minimum insulation resistance between the battery´s circuit and other local conductive parts should be greater than 100 Ohm/V (of battery nominal voltage) corresponding to a leakage current < 10 mA."

Note:
"Before an inspection separate the battery system from the fix installation and check if there is a dangerous voltage between the battery and its rack or cabinet. ..."

With battery system > DC 120 V the rack or cabinet made of metal has to be connected to a protective conductor or there is a protection insulation against the battery and the mounting location. (Chapter 5.2 in EN 50272-2)

This insulation must withstand 4000 V for one minute.

Note:
Protection against direct and indirect touching can be used for battery units with a rated voltage <= DC 120 V. In this case the requirements of metallic battery racks and cabinets are not valid (acc. to 5.2 in EN 50272-2).

Touch protection must be provided for all active parts at voltages > 60 V DC with insulation, covers and distance.

### 6.2.5 Installation

Batteries shall be installed in clean, dry locations. They must be secured against falling items and dirt.

## 6.3 Preparations

- Check each cell/ monobloc separately by measuring the open circuit voltage.

  2 Volt cell: U 2.11 V
  6 Volt monobloc: U 6.33 V
  12 Volt monobloc: U 12.66 V

  When measuring the open circuit voltage pay attention to polarity (perhaps wrong mounting)
- If CEAG Notlichtsysteme GmbH has supplied drawings for the installations, the cells / monoblocs should be installed accordingly.
- Check that the battery racks are stable and horizontal. For the shelf assemblies from 4 levels and 2 rows or 5 levels and 3 rows, the assembly should be anchored with the building.
- The racks or cabinets should provide adequate ventilation above and below to allow the heat produced by the batteries and their charging system to escape. The distance between cells or monoblocs shall be approx. 10 mm, at least 5 mm.

## 6.4 Mounting

- For mounting use insulated tools. It is recommended to protect yourself by wearing rubber gloves, protection glasses and clothes (incl. safety boots). Remove any metal objects such as watches or any other items of jewelry, especially in the case of installation in a cabinet (see also chapter 2).
- The connections should be tightened by means of an insulated torque wrench, set to the following:

| | |
|---|---|
| G-M5 terminal: | 5 ± 1 Nm |
| M6 male screw terminal: | 6 ± 1 Nm |
| M6 female screw terminal: | 11 ± 1 Nm |
| M8 male screw terminal: | 8 ± 1 Nm |
| M8 female screw terminal: | 20 ± 1 Nm |
| M12 male screw terminal: | 25 ± 1 Nm |
| Inch 10-32x0.425: | 6 ± 1 Nm |

- Check total battery voltage, which should correspond to the number of monoblocs connected in series. The open circuit voltage of single cells should not vary from each other by more than 0.02 V among each other. For monobloc – batteries the following maximum differences are allowed:

6 V - monobloc: 0.04 V
12 V - monobloc: 0.05 V

## 6.5 Parallel Arrangements

Preconditions and features for 2 to 10 strings in parallel:

- The connector cables for positive and negative terminals of each battery string must have the same length.
- The minimum cable size for the end connectors of a string is 25 mm/100 Ah string capacity.
- The end-connector cables must be placed on a copper bar with at least 100 mm/100 Ah string capacity with the shortest possible distance.
- It is a must to have a circuit breaker for each string or every two strings.
- The strings must all have the same number of cells and temperature.

If these requirements are fulfilled paralleling of up to 10 strings is possible. All battery performance data have to be applied to the end terminal of each string.

Also, the type of lead-acid batteries may differ as long as the requested charging voltage (Vpc) per string is fulfilled.

First every single string has to be pre assembled. Then check, if strings have the same state of charge, and therefore a similar open circuit voltage, before connecting them in parallel.

## 6.6 Operation Positions for AGM Cells and Monoblocs

The following figures show the possible operation positions for valve regulated lead acid AGM cells and monoblocs in conservation-charging operation.

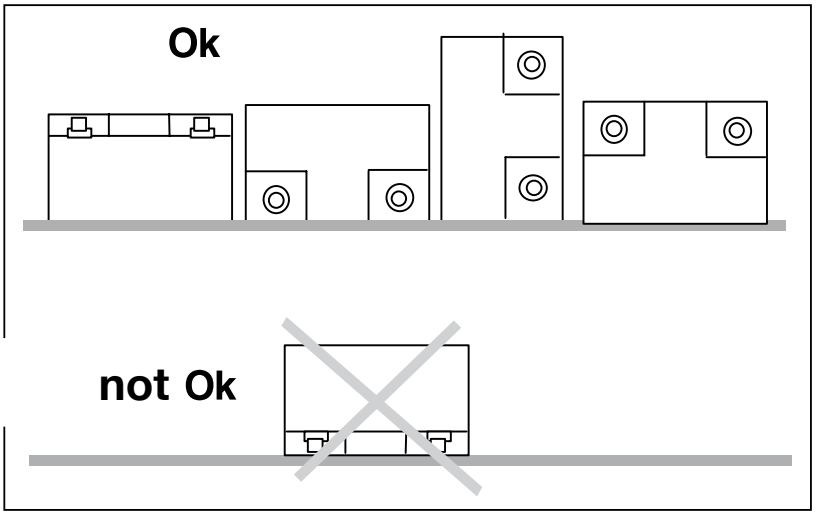



fig. 3: operation positions for AGM monoblocs

## 7 Commissioning

Further information about operating can be found in the operating instructions for ZB-S, No. 300 80 001 451.

## 8 Operating

### 8.1 Safety Notes

**⚠ WARNING! Risk of Injury!**
**Improper mounting and installation can cause serious personal injury and / or material damage. This work must only be performed by authorised , skilled and adequate personnel who have received instructions providing information on the device and in observance of the local safety regulations.**

Before work begins:
- Before work on the battery begins check its completeness and technical correctness.
- Ensure there is enough free moving space.

During operation:
- When failures arise first of all switch battery off and protect against reengagement.

When working on and with the battery it is necessary to wear:
- Safety boots which protect against falling parts and against slipping on non – anti – slip floor.

## 9 Maintenance

### 9.1 Safety Notes

**⚠ WARNING! Risk of Injury!**
**Improper maintenance work can cause serious personal injury and / or material damage. This work has to be performed only by authorised, skilled and adequate personnel who have received instructions providing information on the device and in observance of local safety regulations.**

### 9.2 Maintenance

**ATTENTION! Material Damage!**
**Never use a synthetic cloth or sponge to clean cells / monoblocs. Use water (wet cloth) without additives.**

#### 9.2.1 General Items and Checks (acc. to Operating Instructions/Appendix)

- Periodic inspections and maintenance are necessary regarding:
  - charge voltage and current settings,
  - the discharge conditions,
  - the temperature levels,
  - the storage conditions,
  - the cleanliness of the battery and equipment
  - and other conditions relevant to safety issues and battery´s service life (battery room ventilation, for example).
- Periodic discharges can be used to assess the available operating endurance, to detect faulty cells/ monoblocs and ageing symptoms of the battery, in order to consider battery replacement in due time.
- VRLA (Valve-Regulated Lead-Acid Batteries) batteries do not require topping-up with water. That´s the reason why they were called ”maintenance-free“. Pressure valves are used for sealing and cannot be opened without destruction. Therefore, they are defined as ”Valve-Regulated“ lead-acid batteries (VRLA-batteries).
- Even if VRLA-batteries are called ”maintenance-free“ they sometimes need inspection (see ”Operating Instructions“ for details):

- At least every 6 months measure and record:
  - Battery voltage
  - Voltage of several cells/blocs (approx. 20%)
  - Surface temperature of several cells/blocs
  - Battery-room temperature

  Annual visual check:
  - bolted assemblies (checking unsecure bolted assemblies to adjust them)
  - Battery rack and accommodation
  - ventilation

If the cell/bloc voltages differ from the average float charge voltage by more than a specified +/- tolerance as stated in table 7 or if the surface temperature difference between cells/blocs exceeds 5 K, the service agent should be contacted.

| Operation since | 6-V-monoblocs | 12-V-monoblocs |
|---|---|---|
| | 6.81 V | 13.62 V |
| < 6 months | 6.60 - 7.19 V | 13.33 - 14.16 V |
| > 6 months | 6.64 - 7.16 V | 13.38 - 14.11 V |

chart 7: Valid range of conservation charging voltage

### 9.2.2 Cleaning of Batteries

- It is not allowed to open valves and covers.
- Never use a synthetic cloth or sponge to clean the cells and plastic parts of the battery. Use water (wet cloth) without additives.
- After cleaning the battery cover has to be dried, e. g. with compressed air or cleaning cloth.

## 10 Failures

### 10.1 Reaction to Failure

Further information about failures can be found in the operating instructions for ZB-S, No. 300 80 001 457.

## 11 Spare parts

Only use original spare parts from the manufacturer.

**! ATTENTION!**
**Wrong or faulty spare parts from other manufacturers can cause serious damage to the battery. Ensure the same charging state when changing the battery blocs.**

### 11.1 Ordering Spare Parts

Please state the following when ordering spare parts:
- order number
- rated capacity
- type

In case of complaints you need a RMA - number from us. For further information see www.ceag.de!

81700747

# Operating Instruction
# Stationary valve regulated lead-acid batteries

**Nominal data**

- Nominal voltage $U_N$ : 2.0V x number of cells
- Nominal capacity $C_N = C_{10}; C_{20}$ : 10 h; 20 h discharge (see type plate on cells/blocks and technical data in these instructions)
- Nominal discharge current $I_N = I_{10}; I_{20}$ : $C_N / 10$ h; $C_N / 20$ h
- Final discharge voltage $U_f$ : see technical data in these instructions
- Nominal temperature $T_N$ : 20° C; 25° C

Assembly and CE-marking by: _____ EXIDE Technologies order no.: _____ date: _____

Commissioned by: _____ date: _____

Security signs attached by: _____ date: _____

- Observe these Instructions and keep them located near the battery for future reference! Work on the battery should only be carried out by qualified personnel!

- Do not smoke!
- Do not use any naked flame or other sources of ignition. Risk of explosion and fire!

- While working on batteries wear protective eye-glasses and clothing.
- Observe the accident prevention rules as well as EN 50272-2 and EN 50110-1.

- Any acid splashes on the skin or in the eyes must be flushed with plenty of water immediately. Then seek medical assistance. Spillages on clothing should be rinsed out with water.

- Explosion and fire hazard, avoid short circuits.

- Electrolyte is very corrosive. In normal working conditions contact with electrolyte is impossible. If the cell or block container is damaged do not touch the exposed electrolyte because it is corrosive.

- Cells and blocks are heavy. Always use suitable handling equipment for transportation.
- Handle with care because cells/blocks are sensitive to mechanical shock.

- Caution! Metal parts of the battery are always alive, therefore do not place items or tools on the battery!

- Keep children away from batteries.

**Non-compliance with operating instructions, installations or repairs made with other than original accessories and spare parts or with accessories and spare parts not recommended by the battery manufacturer or repairs made without authorization (e. g. opening of valves) render the warranty void.**


Spent batteries have to be collected and recycled separately from normal household wastes (EWC 160601). The handling of spent batteries is described in the EU Battery Directive (91/157/EEC) and their national transitions (UK: HS Regulation 1994 No. 232, Ireland: Statory Instrument No. 73/2000). Contact your supplier to agree upon the recollection and recycling of your spent batteries or contact a local and authorized Waste Management Company.

Stationary valve regulated lead acid batteries do not require topping-up water. Pressure valves are used for sealing and cannot be opened without destruction.

| AGM-Type | 10-32x0.425 | G-M5 | F-M6 | M-M6 | M-M8 | F-M8 |
|---|---|---|---|---|---|---|
| Marathon L | -- | -- | -- | 6 Nm | 8 Nm | 20 Nm |
| Marathon M/M-FT | 6 Nm | -- | 11 Nm | 6 Nm | -- | -- |
| Sprinter P | -- | -- | -- | 6 Nm | 8 Nm | -- |
| Sprinter S | -- | -- | 11 Nm | -- | -- | -- |
| Powerfit S300 | -- | 5 Nm | -- | -- | -- | -- |
| Powerfit S500 | -- | -- | -- | 6 Nm | 8 Nm | -- |

| Gel-Type | G-M5 | F-M5 | G- M6 | A | F-M8 | F-M10 |
|---|---|---|---|---|---|---|
| A 400 | 5 Nm | -- | 6 Nm | 8 Nm | -- | 17 Nm |
| A 500 | 5 Nm | -- | 6 Nm | 8 Nm | -- | -- |
| A 600 cells | -- | -- | -- | -- | 20 Nm | -- |
| A 600 blocks | -- | -- | -- | -- | 12 Nm | -- |
| A 700 | -- | 6 Nm | -- | -- | 20 Nm | -- |

All torques apply with a tolerance of ± 1 Nm **Table 1: Torque**

## 1. Start Up

Check all cells/blocks for mechanical damage, correct polarity and firmly seated connectors. Torques as shown in table 1 apply for screw connectors.

Before installation the supplied rubber covers should be fitted to both ends of the connector cables (pole covers).
Control of insulation resistance:
New batteries: > 1M Ω
Used batteries: > 100 Ω/Volt

Connect the battery with the correct polarity to the charger (pos. pole to pos. terminal). The charger must not be switched on during this process, and the load must not be connected. Switch on charger and start charging following instruction no. 2.2.

## 2. Operation

For the installation and operation of stationary batteries EN 50 272-2 is mandatory.
Battery installation should be made such that temperature differences between individual units do not exceed 3 degrees Celsius (Kelvin).

### 2.1 Discharge

Discharge must not be continued below the voltage recommended for the discharge time.
Deeper discharges must not be carried out unless specifically agreed with the manufacturer. Recharge immediately following complete or partial discharge.

### 2.2 Charging

All charging must be carried out according to DIN 41773 (IU-characteristic with limit values: I-constant: ± 2%; U-constant: ± 1%).

Depending on the charging equipment, specification and characteristics alternating currents flow through the battery. Alternating currents and the reaction from the loads may lead to an additional temperature increase of the battery, and strain the electrodes with possible damages (see 2.5) which can shorten the battery life. Depending on the installation charging (acc. to EN 50272-2) may be carried out in following operations.

**a.) Standby Parallel Operation**

Here, the load, battery and battery charger are continuously in parallel. Thereby, the charging voltage is the operation voltage and at the same time the battery installation voltage. With the standby parallel operation, the battery charger is capable, at any time, of supplying the maximum load current and the battery charging current. The battery only supplies current when the battery charger fails. The charging voltage should be set **acc. to table 2** measured at the end terminals of the battery.

| | Float voltage [Vpc] | Nominal temp. [° C] |
|---|---|---|
| Marathon L | 2.27 | 20 |
| Marathon M | 2.27 | 25 |
| Sprinter P | 2.27 | 25 |
| Sprinter S | 2.27 | 25 |
| Powerfit S 300 | 2.27 | 20 |
| Powerfit S 500 | 2.27 | 20 |
| A 400 | 2.27 | 20 |
| A 500 | 2.30 | 20 |
| A 600 | 2.25 | 20 |
| A 700 | 2.25 | 20 |

**Table 2: Float voltage**

To reduce the charging time a boost charging stage can be applied in which the charging voltage **acc. to table 3** can be adjusted (standby-parallel operation with boost recharging stage). Automatic change over to charging voltage **acc. to table 2** should be applied.

| | Voltage on boost charge stage [Vpc] | Nominal temp. [° C] |
|---|---|---|
| Marathon L | 2.35-2.40 | 20 |
| Marathon M | 2.35-2.40 | 25 |
| Sprinter P | 2.35-2.40 | 25 |
| Sprinter S | 2.35-2.40 | 25 |
| Powerfit S 300 | 2.35-2.40 | 20 |
| Powerfit S 500 | 2.35-2.40 | 20 |
| A 400 | 2.37-2.40 | 20 |
| A 500 | 2.40-2.45 | 20 |
| A 600 | 2.35-2.40 | 20 |
| A 700 | 2.35-2.40 | 20 |

**Table 3: Voltage on boost charging stage**

**b.) Buffer operation**
With buffer operation the battery charger is not able to supply the maximum load current at all times. The load current intermittently exceeds the nominal current of the battery charger. During this period the battery supplies power. This results in the battery not fully charged at all times. Therefore, depending on the load the charge voltage must be set **acc. to table 4**. This has to be carried out in accordance with the manufacturers instructions.

| | Voltage in buffer operation [Vpc] | Nominal temp. [° C] |
|---|---|---|
| Marathon L | 2.27 | 20 |
| Marathon M | 2.29-2.33 | 25 |
| Sprinter P | 2.30 | 25 |
| Sprinter S | 2.29-2.33 | 25 |
| Powerfit S 300 | 2.27 | 20 |
| Powerfit S 500 | 2.27 | 20 |
| A 400 | 2.27 | 20 |
| A 500 | 2.30-2.35 | 20 |
| A 600 | 2.27-2.30 | 20 |
| A 700 | 2.27-2.30 | 20 |

**Table 4: Charge voltage in buffer operation**

**c.) Switch-mode operation**
When charging, the battery is separated from the load. The charge voltage of the battery must be set **acc. to table 3** (max. values). The charging process must be monitored. If the charge current reduces to less than 1.5A/100Ah nominal capacity, the mode switches to float charge acc. to item 2.3 or it switches after reaching the voltage value acc. to table 3.

**d.) Battery operation (charge-/discharge operation)**
The load is only supplied by the battery. The charging process depends on the application and must be carried out in accordance with the recommendations of the battery-manufacturer.

**2.3 Maintaining the full charge (float charge)**
Devices complying with the stipulations under DIN 41773 must be used. They are to be set so that the average cell voltage is **acc. to table 2**.

**2.4 Equalizing charge**
Because it is possible to exceed the permitted load voltages, appropriate measures must be taken, e.g. switch off the load. Equalizing charges are required after deep discharges and/or inadequate charges. They can be carried out with 2.40 Vpc (A 500: 2.45 Vpc) for up to 48 hours and with unlimited current.
The cells / bloc temperature must never exceed 45° C. If it does, stop charging or revert to float charge to allow the temperature to drop.

**2.5 Alternating currents**
When recharging up to 2.40 Vpc under operation modes 2.2 the actual value of the alternating current is occasionally permitted to reach 10A (RMS)/100Ah nominal capacity. In a fully charged state during float charge or standby parallel operation the actual value of the alternating current must not exceed 5 A (RMS) /100 Ah nominal capacity.

**2.6 Charging currents**
The charging currents are not limited during standby parallel operation or buffer operation without recharging stage. The charging current should range between the values given in **table 5** (guide values).

In cycling operation, the maximum current values as shown in **table 5** must not be exceeded.

| | Charging current |
|---|---|
| Marathon L | 10 to 30 A per 100Ah |
| Marathon M | 10 to 35 A per 100Ah |
| Sprinter P | 10 to 30 A per 100Ah |
| Sprinter S | 10 to 35 A per 100Ah |
| Powerfit S 300 | 10 to 30 A per 100Ah |
| Powerfit S 500 | 10 to 30 A per 100Ah |
| A 400 | 10 to 35 A per 100Ah |
| A 500 | 10 to 35 A per 100Ah |
| A 600 | 10 to 35 A per 100Ah |
| A 700 | 10 to 35 A per 100Ah |

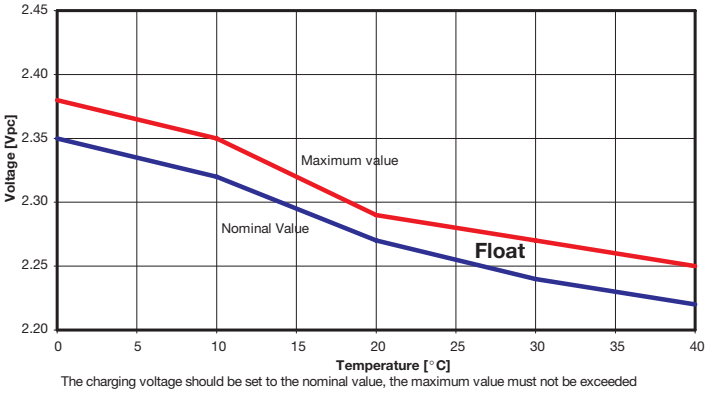
**Table 5: Charging currents**

**2.7 Temperature**
The recommended operation temperature range for lead acid batteries is 10° C to 30° C (best: nominal temperature ± 5K). Higher temperatures will seriously reduce service life. Lower temperatures reduce the available capacity.
The absolute maximum temperature is 55° C and should not exceed 45° C in service.
All technical data refer to a nominal temperature of 20° C and 25° C respectively.

**2.8 Temperature related charge voltage**
The temperature related adjustment has to be carried out **acc. to the following figures 1 to 5**. An adjustment of the charge voltage must not be applied within a specified temperature range as shown in **table 6**.

| | No adjustment within temperature range |
|---|---|
| A 400 | 15° C to 35° C |
| A 500 | 15°C to 35° C |
| A 600 | 15° C to 35° C |
| A 700 | 15° C to 35° C |

**Table 6: Temperature range without voltage adjustment**



The charging voltage should be set to the nominal value, the maximum value must not be exceeded

**Fig. 1: Marathon L and Powerfit S; charging voltage vs. temperature**

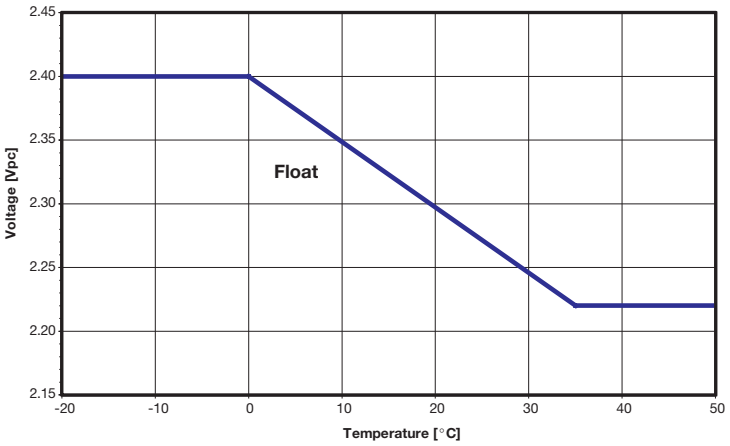



**Fig. 2: Marathon M, Sprinter P, Sprinter S; charging voltage vs. temperature**

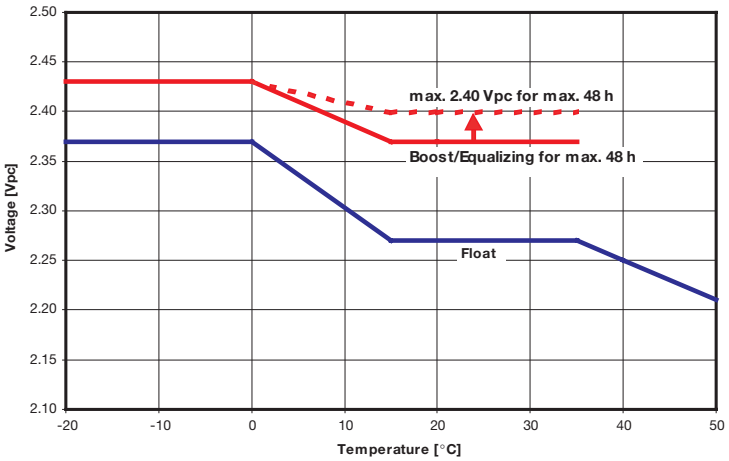



**Fig. 3: A 400; charging voltage vs. temperature**

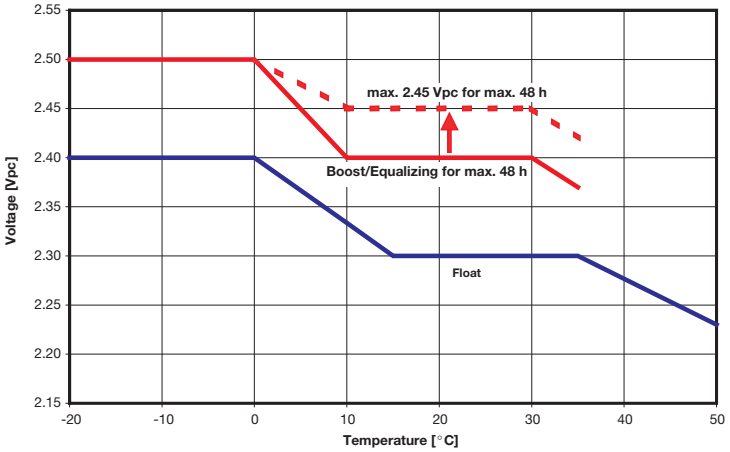



**Fig. 4: A 500; charging voltage vs. temperature**

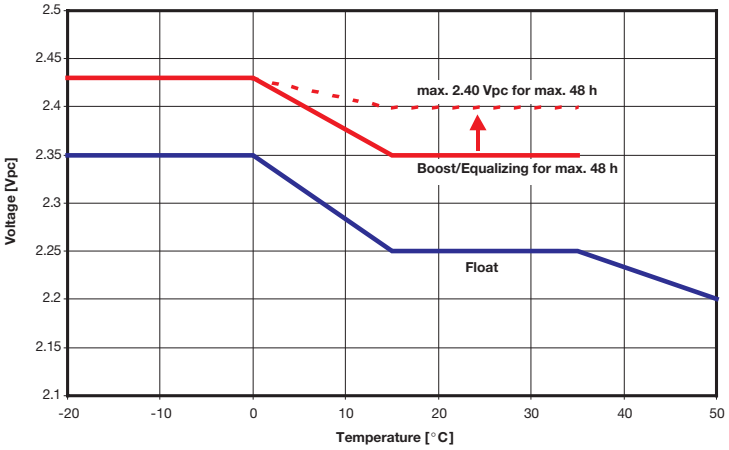



**Fig. 5: A 600, A 700; charging voltage vs. temperature**

### 2.9 Electrolyte

The electrolyte is diluted sulphuric acid and fixed in a glass mat for AGM products or in a gel for Sonnenschein products.

### 3. Battery maintenance and control

Keep the battery clean and dry to avoid creeping currents. The cleaning should be carried out acc. to the information leaflet „Cleaning of batteries" published by ZVEI (German Electrical and Electronic Manufacturer Association, Working Group „Industrial Batteries"). Plastic parts of the battery, especially containers, must be cleaned with pure water without additives.

**At least every 6 month measure and record:**
- Battery voltage
- Float voltage of several cells/blocks
- Surface temperature of several cells/blocks
- Battery-room temperature

**Annual measurement and recording:**
- Battery voltage
- Float voltage of all cells / blocks
- Surface temperature of all cells/blocks
- Battery-room temperature
- Insulation-resistance acc. to DIN 43539 part1

If the cell or block voltage differ from the average float charge voltage by more than the values given in table 7, or if the surface temperature difference between cells / blocks exceeds 5K, the service agent should be contacted.

Deviations of the battery voltage from the value given in **table 2** (acc. to the number of cells) must be corrected.

**Annual visual check:**
- Screw-connections
- Screw-connections without locking devices have to be checked for tightness
- Battery installation and arrangement
- Ventilation

### 4. Tests

Tests have to be carried out according to IEC 60896-21, DIN 43539 part 1.
Special instructions like DIN VDE 0107 and EN 50172 have to be observed.

### Capacity test

In order to make sure the battery is fully charged IU-charge methods as shown in **table 8** can be applied depending on the different battery types.

The current available to the battery must be between 10A /100Ah and 35A/ 100Ah of the nominal capacity.

| | 2V | 4V | 6V | 8V | 12V |
|---|---|---|---|---|---|
| Marathon L | +0.2/-0.1 | -- | +0.35/-0.17 | -- | +0.49/-0.24 |
| Marathon M | -- | -- | +0.35/-0.17 | -- | +0.49/-0.24 |
| Sprinter P | -- | -- | +0.35/-0.17 | -- | +0.49/-0.24 |
| Sprinter S | -- | -- | +0.35/-0.17 | -- | +0.49/-0.24 |
| Powerfit S 300 | -- | -- | +0.35/-0.17 | -- | +0.49/-0.24 |
| Powerfit S 500 | -- | -- | +0.35/-0.17 | -- | +0.49/-0.24 |
| A 400 | -- | -- | +0.35/-0.17 | -- | +0.49/-0.24 |
| A 500 | +0.2/-0.1 | +0.28/-0.14 | +0.35/-0.17 | +0.40/-0.20 | +0.49/-0.24 |
| A 600 | +0.2/-0.1 | -- | +0.35/-0.17 | -- | +0.49/-0.24 |
| A 700 | -- | +0.28/-0.14 | +0.35/-0.17 | -- | -- |

**Table 7: Criteria for voltage measurements**

| | Option 1 | Option 2 |
|---|---|---|
| Marathon L | 2.27 Vpc ≥ 48 hours | 2.40 Vpc ≥ 16 h (max. 48h) followed by 2.27 Vpc ≥ 8h |
| Marathon M | 2.27 Vpc ≥ 48 hours | 2.40 Vpc ≥ 16 h (max. 48h) followed by 2.27 Vpc ≥ 8h |
| Sprinter P | 2.27 Vpc ≥ 48 hours | 2.40 Vpc ≥ 16 h (max. 48h) followed by 2.27 Vpc ≥ 8h |
| Sprinter S | 2.27 Vpc ≥ 48 hours | 2.40 Vpc ≥ 16 h (max. 48h) followed by 2.27 Vpc ≥ 8h |
| Powerfit S 300 | 2.27 Vpc ≥ 48 hours | 2.40 Vpc ≥ 16 h (max. 48h) followed by 2.27 Vpc ≥ 8h |
| Powerfit S 500 | 2.27 Vpc ≥ 48 hours | 2.40 Vpc ≥ 16 h (max. 48h) followed by 2.27 Vpc ≥ 8h |
| A 400 | 2.27 Vpc ≥ 48 hours | 2.40 Vpc ≥ 16 h (max. 48h) followed by 2.27 Vpc ≥ 8h |
| A 500 | 2.30 Vpc ≥ 48 hours | 2.45 Vpc ≥ 16 h (max. 48h) followed by 2.30 Vpc ≥ 8h |
| A 600 | 2.25 Vpc ≥ 72 hours | 2.40 Vpc ≥ 16 h (max. 48h) followed by 2.25 Vpc ≥ 8h |
| A 700 | 2.25 Vpc ≥ 48 hours | 2.40 Vpc ≥ 16 h (max. 48h) followed by 2.25 Vpc ≥ 8h |

**Table 8: Preparation for capacity test (voltage values refer to the nominal temperature. In case of temperatures others than the nominal values see item 2.8)**

**5. Faults**
Call the service agents immediately if faults in the battery or the charging unit are found. Recorded data as described in item 3. must be made available to the service agent. It is recommended that a service contract is taken out with our agent.

**6. Storage and taking out of operation**
To store or decommission cells/blocks for a longer period of time they should be fully charged and stored in a dry frost-free room.
To avoid damage the following charging methods can be chosen:
1. Annual refreshing charge acc. to item 2.4. Gel-batteries A400, A500, A600 and A700 can be stored without refreshing charge for maximum 24 months at 20°C. At average ambient temperatures of more than the nominal temperature shorter intervals can be necessary.

2. Float charging as detailed in 2.3.

**7. Transport**
Cells and blocks must be transported in an upright position. Batteries without any visible damage are not defined as dangerous goods under the regulations for transport of dangerous goods by road (ADR) or by railway (RID). They must be protected against short circuits, slipping, upsetting or damaging. Cells/blocks may be suitable stacked and secured on pallets (ADR and RID, special provision 598). It is prohibited to staple pallets.
No dangerous traces of acid shall be found on the exteriors of the packing unit.
Cells/blocks whose containers leak or are damaged must be packed and transported as class 8 dangerous goods under UN no. 2794.

**8. Central degassing**

**8.1 General items**
The ventilation of battery rooms and cabinets, respectively, must be carried out acc. to EN 50272-2 always. Battery rooms are to be considered as safe from explosions, when by natural or technical ventilation the concentration of hydrogen is kept below 4% in air.
This standard contains also notes and calculations regarding safety distance of battery openings (valves) to potential sources of sparks.

Central degassing is a possibility for the equipment manufacturer to draw off gas. Its purpose is to reduce or to delay, respectively, the accumulation of hydrogen in the ambient of the batteries by conducting hydrogen releasing the vents through a tube system to the outside. On such a way it is also possible to the equipment manufacturer to reduce the safety distance to potential sources of ignition.

Even if the gas releasing the vents will be conducted through the tube system outside, hydrogen ($H_2$) diffuses also through the battery container and through the tube wall.
The following calculation shows when the critical limit of 4% $H_2$ can be achieved using central degassing in a hermetic closed room (e.g. battery cabinet).

Only block batteries equipped by a tube junction for central degassing must be used for this application.

The installation of the central degassing must be carried out in acc. with the equivalent installation instructions. During each battery service also the central degassing must be checked (tightness of tubes, laying in the direction of the electrical circuit, drawing off the end of the tube to the outside).

**8.2 Accumulation of hydrogen up to 4% in air**
The following calculations are based on measurements and are related to cabinets.

The following equation was determined for calculating the numbers of days for achieving the critical gas mixture:

$$x = \frac{k_{/Bloc} * c1 * c2}{c3}$$

with:
- $x$ = Days up to achieving 4% $H_2$ in air
- $k_{/Bloc}$ = Constant per specific block battery type acc. to **table 9**
- $c1$ = Coefficient for actual free volume inside the cabinet acc. to**table 10**
- $c2$ = Coefficient for actual battery temperature acc. to**table 10**
- $c3$ = Coefficient for actual numbers of blocks in total

Therefore, it is possible to calculate using the tables 9 and 10 after how many days the 4% $H_2$-limit can be achieved in the cabinet for the mentioned battery types, different configurations and conditions.

**Calculation example:**

48 V-battery (e.g. Telecom)
4 * M12V155FT — c3 = 4
k = 750
Free air volume 70% — c1 = 0.9
Battery temperature 20° C — c2 = 1

$$x = \frac{k_{/block} * c1 * c2}{c3} = 168 \text{ days}$$

The 168 days are reduced to 99 days only at 30° C because c2 = 0.59.

| $V_{free}$ [%] | c1 | T [¡ C] | c2 |
|---|---|---|---|
| 10 | 0.13 | 25 | 1 |
| 15 | 0.19 | 26 | 0.91 |
| 20 | 0.26 | 28 | 0.73 |
| 25 | 0.32 | 30 | 0.59 |
| 30 | 0.38 | 32 | 0.48 |
| 35 | 0.45 | 34 | 0.40 |
| 40 | 0.51 | 36 | 0.34 |
| 45 | 0.58 | 38 | 0.29 |
| 50 | 0.64 | 40 | 0.25 |
| 55 | 0.70 | 42 | 0.21 |
| 60 | 0.77 | 44 | 0.18 |
| 65 | 0.83 | 46 | 0.16 |
| 70 | 0.90 | 48 | 0.14 |
| 75 | 0.96 | 50 | 0.12 |
| 80 | 1.02 | 52 | 0.11 |
| 85 | 1.09 | 54 | 0.10 |
| 90 | 1.15 | 55 | 0.09 |

**Table 10: Coefficients for free air volume (c1) and temperature (c2)**

### 8.3 Special conditions and instructions

The free air volume inside the cabinet has to be determined by the user.

The batteries must be monitored regarding temperature. Exceeding the limit of 55° C is not allowed.

Malfunctions of equipment and (or) batteries may lead to a faster accumulation of $H_2$ and, therefore, time reduction. In such a case, the above mentioned calculation methods cannot be applied anymore.

Discharge and re-charging at float voltage level can be carried out as much as necessary during the time (days) determined.

It is allowed to carry out monthly boost or equalizing charging for maximum 12 hours only and at the maximum allowed voltage level specified for the battery. For all applications in addition to this, e.g. buffer or cyclical operations, consultation with EXIDE Technologies is necessary.

The time (days) is valid for temperature compensated charge voltages acc. to the operating instructions and take into account aging effects of the battery (increasing residual charge current).

## 9. Technical Data

The following tables contain values of either capacities ($C_n$) or discharge rates (constant current or constant power) at different discharge times ($t_n$) and to different final voltages ($U_f$).

All technical data refer to either 20° C or 25° C (depends on battery type).

### 9.1 AGM - Types

#### 9.1.1. Marathon L

| Discharge time $t_n$ | 10 min | 30 min | 1 h | 3 h | 5 h | 10 h | Length | Width | Height max. | Weight approx. |
|---|---|---|---|---|---|---|---|---|---|---|
| Capacity $C_n$ [Ah] | $C^1/_6$ | $C^1/_2$ | $C_1$ | $C_3$ | $C_5$ | $C_{10}$ | [mm] | [mm] | [mm] | [kg] |
| L12V15 | 6.5 | 8.5 | 9.9 | 13.2 | 13.0 | 14.0 | 181 | 76 | 167 | 6.5 |
| L12V24 | 10.6 | 13.9 | 15.8 | 21.0 | 21.5 | 23.0 | 168 | 127 | 174 | 10.0 |
| L12V32 | 14.1 | 18.7 | 21.4 | 27.9 | 30.0 | 32.0 | 198 | 168 | 175 | 13.5 |
| L12V42 | 19.6 | 25.7 | 29.4 | 38.1 | 39.5 | 42.0 | 234 | 169 | 190 | 18.5 |
| L12V55 | 21.6 | 29.5 | 36.0 | 44.7 | 49.0 | 55.0 | 272 | 166 | 190 | 22.0 |
| L12V80 | 30.3 | 41.5 | 51.2 | 65.1 | 71.0 | 80.0 | 359 | 172 | 226 | 30.0 |
| L6V110 | 48.4 | 65.0 | 75.5 | 102.3 | 107.0 | 112.0 | 272 | 166 | 190 | 23.0 |
| L6V160 | 66.6 | 93.5 | 111.0 | 133.5 | 146.0 | 162.0 | 359 | 171 | 226 | 31.5 |
| L2V220 | 87.4 | 127.0 | 150.0 | 186.6 | 198.0 | 220.0 | 208 | 135 | 282 | 16.0 |
| L2V270 | 106.3 | 155.5 | 183.0 | 229.2 | 243.0 | 270.0 | 208 | 135 | 282 | 18.3 |
| L2V320 | 135.8 | 190.5 | 225.0 | 271.8 | 288.0 | 320.0 | 208 | 201 | 282 | 24.2 |
| L2V375 | 155.8 | 221.5 | 262.0 | 318.0 | 337.5 | 375.0 | 208 | 201 | 282 | 26.5 |
| L2V425 | 169.9 | 247.0 | 291.0 | 360.0 | 382.5 | 425.0 | 208 | 201 | 282 | 28.8 |
| L2V470 | 186.6 | 277.0 | 324.0 | 399.0 | 428.5 | 470.0 | 208 | 270 | 282 | 32.6 |
| L2V520 | 204.1 | 304.5 | 357.0 | 438.0 | 474.0 | 520.0 | 208 | 270 | 282 | 35.0 |
| L2V575 | 220.8 | 334.5 | 394.0 | 486.0 | 520.0 | 575.0 | 208 | 270 | 282 | 37.3 |
| $U_f$ [V] (2 V cell) | 1.60 | 1.60 | 1.60 | 1.70 | 1.75 | 1.80 | | | | |
| $U_f$ [V] (6 V block) | 4.80 | 4.80 | 4.80 | 5.10 | 5.25 | 5.40 | | | | |
| $U_f$ [V] (12 V block) | 9.60 | 9.60 | 9.60 | 10.20 | 10.50 | 10.80 | | | | |

All technical data refer to 20° C.

#### 9.1.2 Sprinter P / XP

| Type | Nominal voltage [V] | 15 min.-power [W], $U_f$ = 1.60 V per cell | Capacity $C_{10}$ [Ah], $U_f$ = 1.80 V per cell | Length [mm] | Width [mm] | Height max. [mm] | Weight approx. [kg] |
|---|---|---|---|---|---|---|---|
| P12V570 | 12 | 570 | 21 | 168 | 177 | 126 | 9.5 |
| P12V600 | 12 | 600 | 23.3 | 168 | 127 | 174 | 9.5 |
| P12V875 | 12 | 875 | 39.8 | 198 | 168 | 175 | 14.5 |
| P12V1220 | 12 | 1220 | 49.5 | 234 | 169 | 190 | 19.5 |
| P12V1575 | 12 | 1575 | 59.2 | 272 | 166 | 190 | 24.0X |
| XP12V3000 | 12 | 1746 | 89.4 | 307.5 | 171 | 239 | 32.8 |
| P 6V1700 | 6 | 1700 | 118 | 272 | 166 | 190 | 25.0 |
| P 6V2030 | 6 | 2030 | 178 | 359 | 172 | 226 | 32.5 |

These batteries are especially designed for high rate discharges. Further details depending on the discharge time and cut off voltage must be taken from the actual product brochure.

All technical data refer to 20° C.

## 9.2 GEL - Types

### 9.2.1. A 400

| Discharge time $t_n$ | 10 min | 30 min | 1 h | 3 h | 5 h | 10 h | Length | Width | Height max. | Weight approx. |
|---|---|---|---|---|---|---|---|---|---|---|
| Capacity $C_n$ [Ah] | $C^1/_6$ | $C^1/_2$ | $C_1$ | $C_3$ | $C_5$ | $C_{10}$ | [mm] | [mm] | [mm] | [kg] |
| A406/165 | 53.0 | 80.0 | 96.0 | 132 | 143.5 | 165 | 244 | 190 | 282 | 31.5 |
| A412/5,5 | 1.83 | 2.80 | 3.40 | 4.80 | 5.00 | 5.00 | 152 | 66 | 98 | 2.5 |
| A412/8,5 | 2.67 | 3.90 | 4.70 | 6.60 | 7.50 | 8.00 | 152 | 98 | 98 | 3.6 |
| A412/12 | 3.83 | 5.50 | 6.80 | 8.70 | 10.0 | 12.0 | 181 | 76 | 156 | 5.6 |
| A412/20 | 7.00 | 9.50 | 12.0 | 15.0 | 16.5 | 20.0 | 167 | 176 | 126 | 8.5 |
| A412/32 | 11.3 | 16.5 | 20.0 | 26.7 | 29.0 | 32.0 | 210 | 175 | 181 | 14.1 |
| A412/50 | 16.8 | 25.5 | 31.0 | 40.8 | 44.5 | 50.0 | 278 | 175 | 196 | 19.0 |
| A412/65 | 19.3 | 29.0 | 42.0 | 51.9 | 57.5 | 65.0 | 353 | 175 | 220 | 23.5 |
| A412/85 | 27.6 | 42.5 | 52.0 | 68.4 | 74.5 | 85.0 | 204 | 244 | 276 | 32.0 |
| A412/90 | 29.5 | 44.5 | 53.0 | 72.9 | 81.5 | 90.0 | 284 | 267 | 237 | 35.0 |
| A412/100 | 30.5 | 45.5 | 54.0 | 75.3 | 85.0 | 100 | 513 | 189 | 223 | 40.0 |
| A412/120 | 38.0 | 56.0 | 71.0 | 87.9 | 98.0 | 120 | 513 | 223 | 223 | 49.0 |
| A412/180 | 53.6 | 81.0 | 96.0 | 138 | 152 | 180 | 518 | 274 | 244 | 64.5 |
| A412/120 FT | 35.0 | 52.5 | 66.0 | 88.5 | 97.5 | 110 | 115 | 548 | 275 | 41.5 |
| $U_f$ [V] (6 V block) | 4.8 | 4.8 | 4.95 | 5.1 | 5.1 | 5.4 | | | | |
| $U_f$ [V] (12 V block) | 9.6 | 9.6 | 9.9 | 10.2 | 10.2 | 10.8 | | | | |

All technical data refer to 20° C.

### 9.2.2. A 500

| Discharge time $t_n$ | 10 min | 30 min | 1 h | 3 h | 5 h | 10 h | 20 h | Length | Width | Height max. | Weight approx. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Capacity $C_n$ [Ah] | $C^1/_6$ | $C^1/_2$ | $C_1$ | $C_3$ | $C_5$ | $C_{10}$ | $C_{20}$ | [mm] | [mm] | [mm] | [kg] |
| A502/10 | 4.80 | 6.40 | 7.10 | 9.00 | 9.50 | 10.0 | 10.0 | 53 | 51 | 98 | 0.7 |
| A504/3.5 | 1.40 | 1.95 | 2.30 | 3.00 | 3.00 | 3.00 | 3.50 | 91 | 35 | 64 | 0.5 |
| A506/1.2 | 0.50 | 0.65 | 0.80 | 1.20 | 1.00 | 1.00 | 1.20 | 97 | 26 | 56 | 0.3 |
| A506/3.5 | 1.40 | 1.95 | 2.30 | 3.00 | 3.00 | 3.00 | 3.50 | 135 | 35 | 64 | 0.7 |
| A506/4.2 | 1.10 | 1.75 | 2.50 | 3.90 | 4.00 | 4.00 | 4.20 | 52 | 62 | 102 | 0.9 |
| A506/6.5 | 2.60 | 3.50 | 4.00 | 4.80 | 5.50 | 6.00 | 6.50 | 152 | 35 | 98 | 1.3 |
| A506/10 | 4.80 | 6.40 | 7.10 | 9.00 | 9.50 | 10.0 | 10.0 | 152 | 51 | 98 | 2.1 |
| A508/3.5 | 1.40 | 1.95 | 2.30 | 3.00 | 3.00 | 3.00 | 3.50 | 179 | 34 | 64 | 1.0 |
| A512/1.2 | 0.50 | 0.65 | 0.80 | 1.20 | 1.00 | 1.00 | 1.20 | 98 | 50 | 55 | 0.7 |
| A512/2 | 0.80 | 1.10 | 1.50 | 1.80 | 2.00 | 2.00 | 2.00 | 179 | 34 | 64 | 1.0 |
| A512/3.5 | 1.40 | 1.95 | 2.30 | 3.00 | 3.00 | 3.00 | 3.50 | 135 | 67 | 64 | 1.5 |
| A512/6.5 | 2.60 | 3.50 | 4.00 | 4.80 | 5.50 | 6.00 | 6.50 | 152 | 66 | 98 | 2.6 |
| A512/10 | 4.80 | 6.40 | 7.10 | 9.00 | 9.50 | 10.0 | 10.0 | 152 | 98 | 98 | 4.0 |
| A512/16 | 7.00 | 9.00 | 10.6 | 13.8 | 14.5 | 15.0 | 16.0 | 181 | 76 | 167 | 6.0 |
| A512/25 | 7.80 | 11.4 | 14.4 | 18.6 | 20.5 | 22.0 | 25.0 | 167 | 176 | 126 | 9.6 |
| A512/30 | 11.4 | 16.3 | 20.1 | 24.6 | 26.5 | 27.0 | 30.0 | 197 | 132 | 180 | 11.1 |
| A512/40 | 14.1 | 19.5 | 24.0 | 28.5 | 34.0 | 36.0 | 40.0 | 210 | 175 | 175 | 14.6 |
| A512/55 | 19.3 | 27.6 | 35.7 | 42.9 | 46.5 | 50.0 | 55.0 | 261 | 135 | 230 | 18.8 |
| A512/60 | 22.1 | 30.9 | 37.1 | 48.6 | 52.0 | 56.0 | 60.0 | 278 | 175 | 190 | 20.8 |
| A512/65 | 22.5 | 33.8 | 40.9 | 53.7 | 58.5 | 62.0 | 65.0 | 353 | 175 | 190 | 24.0 |
| A512/85 | 33.1 | 47.5 | 59.0 | 69.0 | 75.5 | 80.0 | 85.0 | 330 | 171 | 236 | 30.0 |
| A512/115 | 37.8 | 58.5 | 67.0 | 84.0 | 95.0 | 104 | 115 | 286 | 269 | 230 | 40.0 |
| A512/120 | 44.5 | 62.0 | 74.0 | 89.7 | 96.0 | 102 | 120 | 513 | 189 | 223 | 41.0 |
| A512/140 | 50.5 | 71.5 | 85.4 | 105 | 113 | 119 | 140 | 513 | 223 | 223 | 48.0 |
| A512/200 | 68.5 | 101 | 120 | 151 | 164 | 173 | 200 | 518 | 274 | 238 | 67.0 |
| $U_f$ [V] (2 V cell) | 1.6 | 1.6 | 1.65 | 1.70 | 1.70 | 1.80 | 1.75 | | | | |
| $U_f$ [V] (4 V block) | 3.2 | 3.2 | 3.3 | 3.4 | 3.4 | 3.6 | 3.5 | | | | |
| $U_f$ [V] (6 V block) | 4.8 | 4.8 | 4.95 | 5.1 | 5.1 | 5.4 | 5.25 | | | | |
| $U_f$ [V] (8 V block) | 6.4 | 6.4 | 6.6 | 6.8 | 6.8 | 7.2 | 7.0 | | | | |
| $U_f$ [V] (12 V block) | 9.6 | 9.6 | 9.9 | 10.2 | 10.2 | 10.8 | 10.5 | | | | |

All technical data refer to 20° C.

Deutsche EXIDE GmbH
Im Thiergarten
63654 Büdingen – Germany

Tel.: +49 (0) 60 42 / 81 544
Fax: +49 (0) 60 42 / 81 398

www.industrialenergy.exide.com

State: August 2007

EXIDE TECHNOLOGIES
INDUSTRIAL ENERGY

**CEAG Notlichtsysteme GmbH**
Senator-Schwartz-Ring 26
59494 Soest
Germany

Tel: +49 (0) 2921/69-870
Fax: +49 (0) 2921/69-617
Web: www.ceag.de
Email: info-n@ceag.de

**Cooper Safety**
Jephson Court
Tancred Close
Royal Leamington Spa
Warwickshire CV31 3RZ
United Kingdom
Tel: +44 (0) 1926 439200
Fax: +44 (0) 1926 439240
Web: www.cooper-safety.com
Email: enquiries@cooper-safety.com

400 71 860 035 (D)/XXX/05.10/WK

COOPER Safety