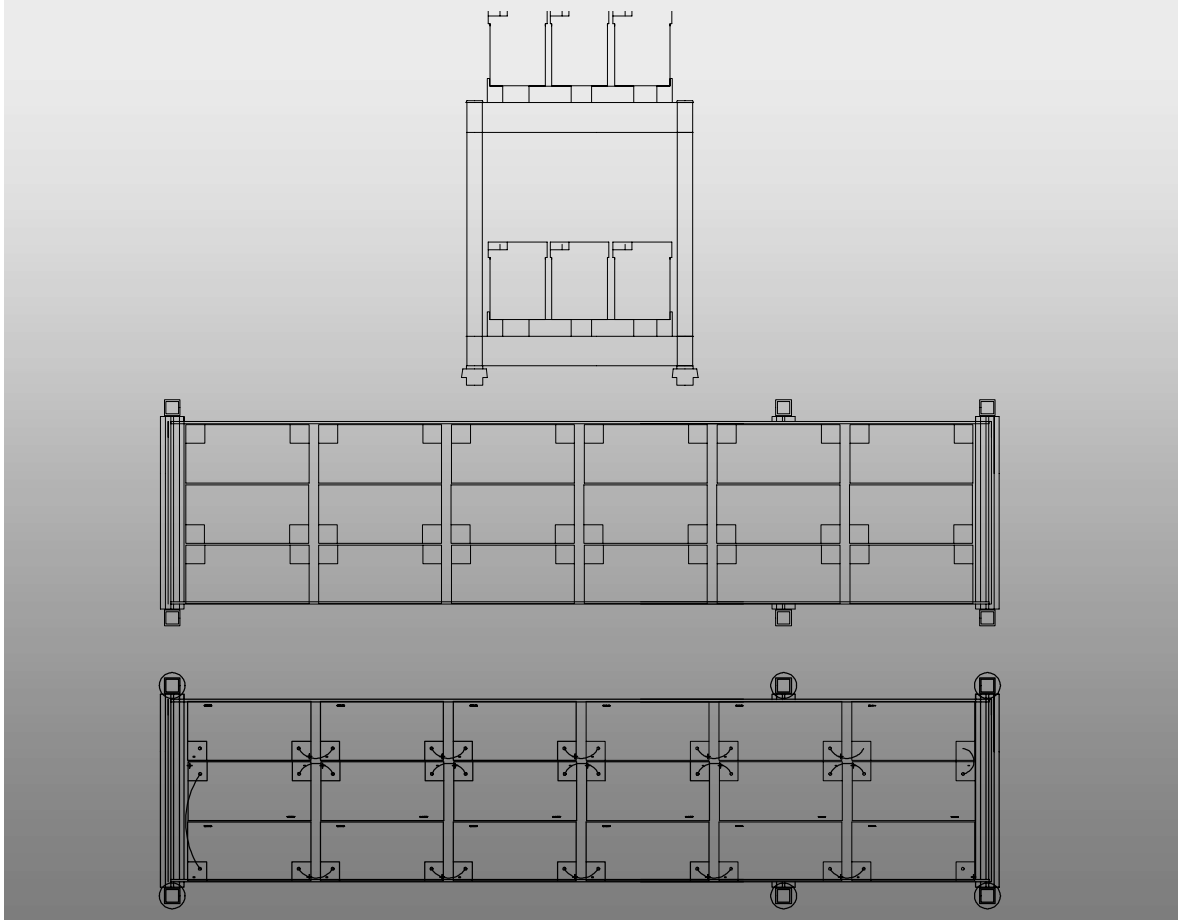
Operating and Installation Instructions

Battery Rack

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

Target group, part 2:
Operator

400 71 860 036



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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 racks, 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

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 racks 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 racks 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

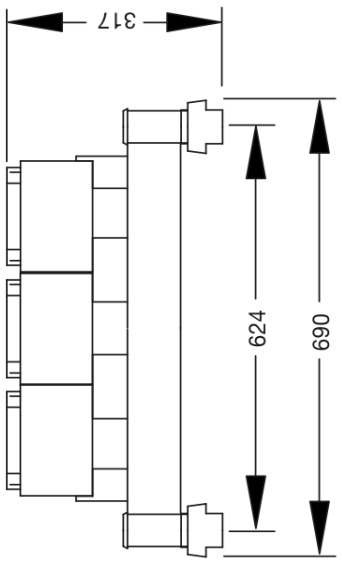
The battery was subjected to a danger analysis. Therefore the construction and design of the battery meets the actual state of the art.

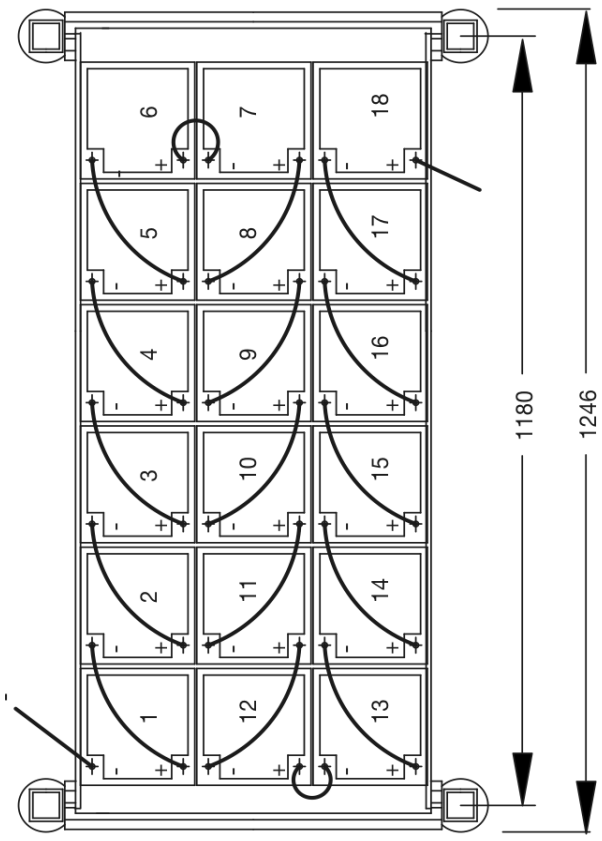
With proper handling the battery is operationally safe.

3 Technical Data

3.1 Battery Racks

3.1.1 Battery Rack 22 Ah





For interconnection see chapter „Circuit Diagrams“

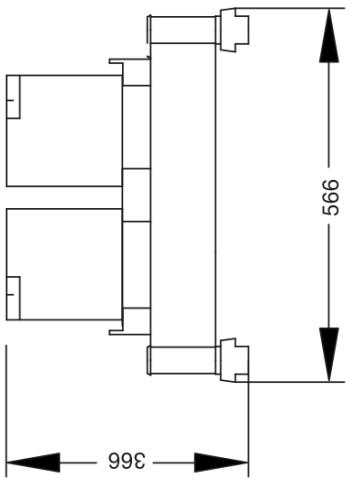
Wiring Set 4 0071 346 805 included

No.	Length	Number
1	100 mm	15
2	150 mm	2

Technical Data

Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 22 Ah
Rated voltage of all batteries	216 V
Number of all batteries	18 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	200 kg
Dimensions in mm (W x H x D)	1246 x 357 x 690
Order no. of battery bloc	40066070461

3.1.2 Battery Rack 33 Ah



Wiring Set 4 0071 346 806 included

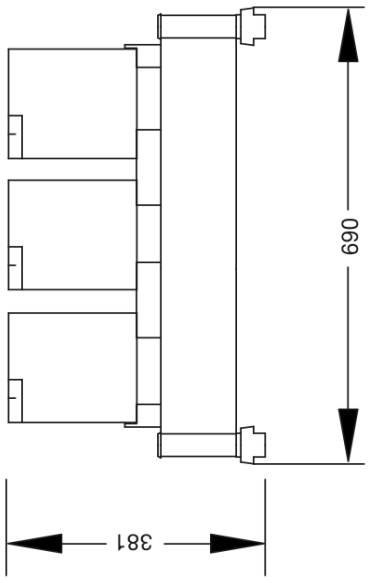
No.	Length	Number
1	110 mm	16
2	140 mm	1

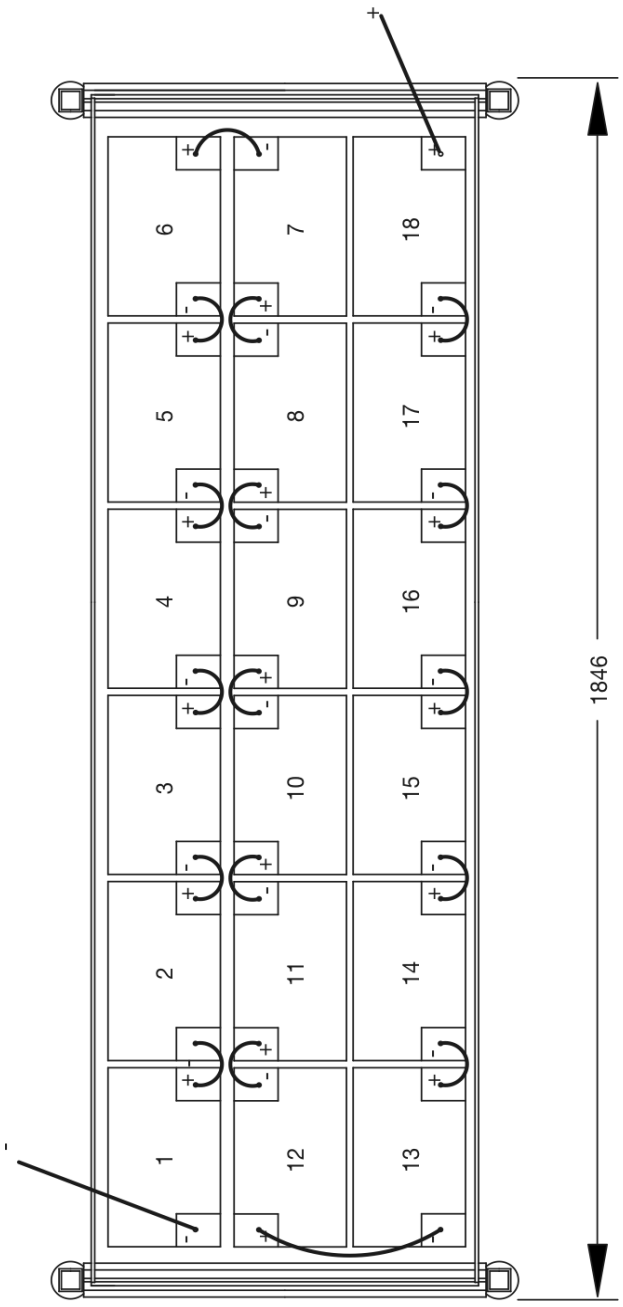
Technical Data

Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 33 Ah
Rated voltage of all batteries	216 V
Number of all batteries	18 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	307 kg
Dimensions in mm (W x H x D)	2156 x 366 x 566
Order no. of battery bloc	4006607011 6

For interconnection see chapter „Circuit Diagrams“

3.1.3 Battery Rack 57 Ah





Wiring Set 4 0071 346 807 included

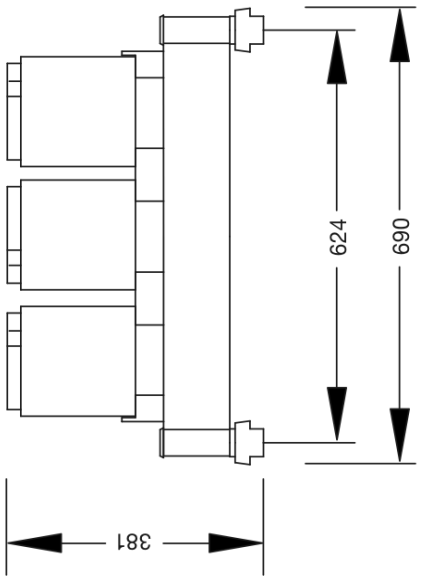
No.	Length	Number
1	140 mm	16
2	320 mm	1

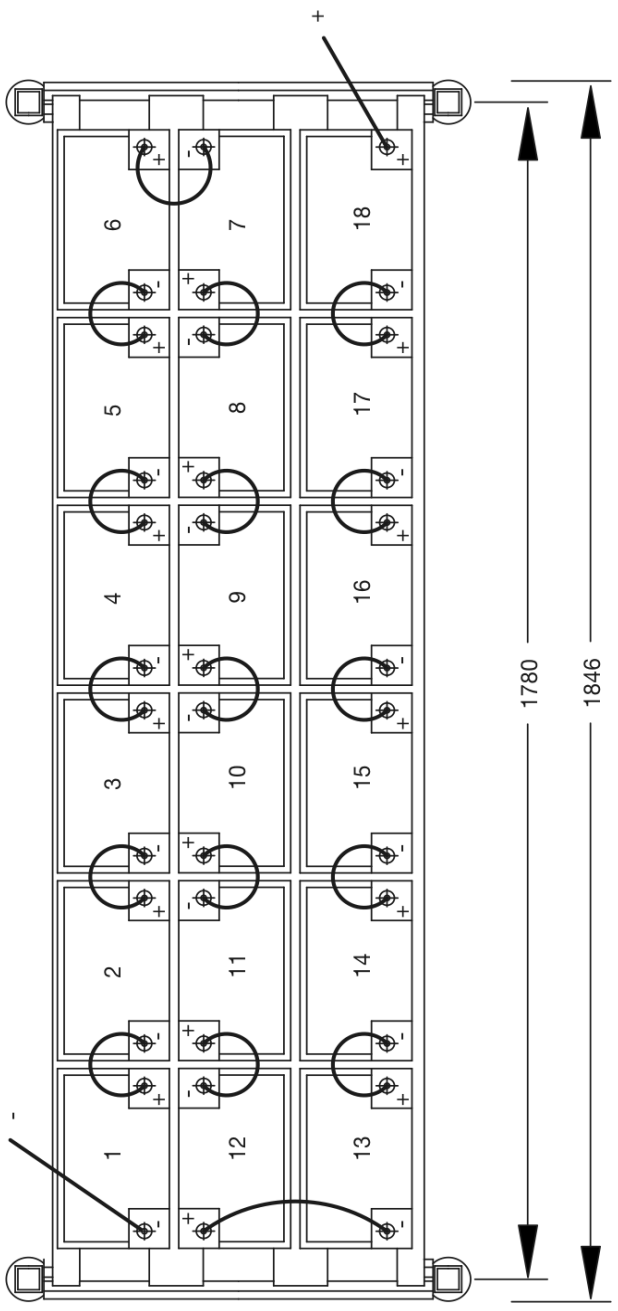
Technical Data

Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 57 Ah
Rated voltage of all batteries	216 V
Number of all batteries	18 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	437 kg
Dimensions in mm (W x H x D)	1846 x 381 x 690
Order no. of battery bloc	40066070118

For interconnection see chapter „Circuit Diagrams“

3.1.4 Battery Rack 63 Ah





Wiring Set 4 0071 346 808 included

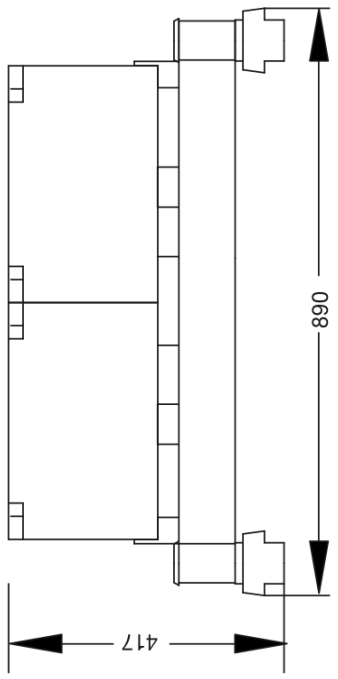
No.	Length	Number
1	100 mm	15
2	170 mm	1
3	400 mm	1

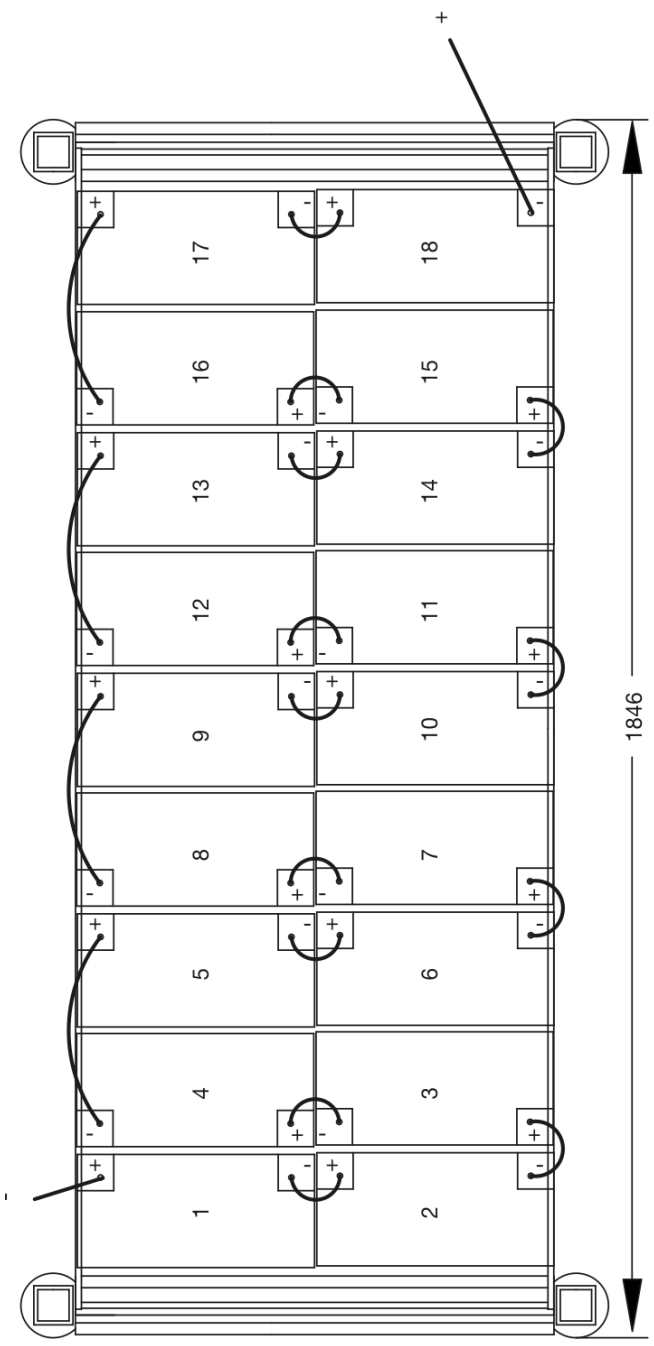
Technical Data

Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 63 Ah
Rated voltage of all batteries	216 V
Number of all batteries	18 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	506 kg
Dimensions in mm (W x H x D)	1846 x 381 x 690
Order no of battery bloc	40066070464

For interconnection see chapter „Circuit Diagrams“

3.1.5 Battery Rack 83 Ah





Wiring Set 4 0071 346 809 included

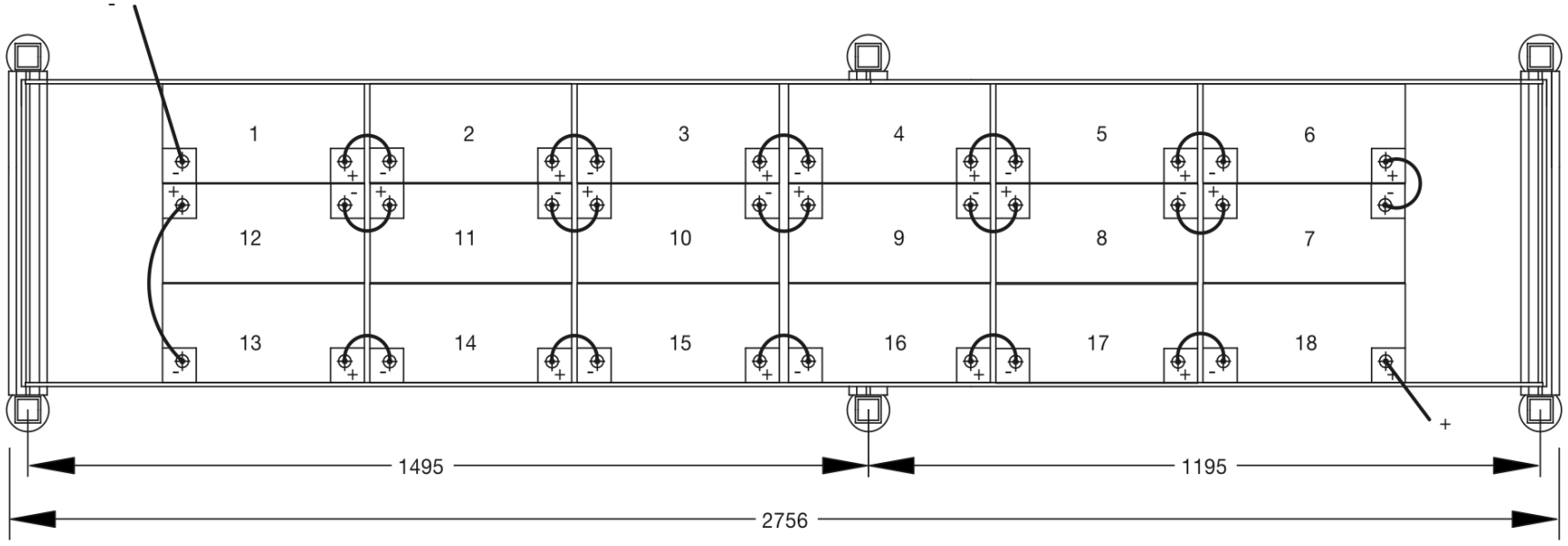
No.	Length	Number
1	170 mm	13
2	360 mm	4

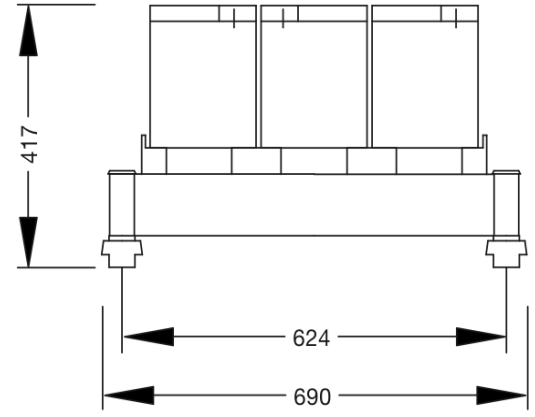
Technical Data

Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 83 Ah
Rated voltage of all batteries	216 V
Number of all batteries	18 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	1006 kg
Dimensions in mm (W x H x D)	1846 x 417 x 890
Order no. of battery bloc	4006607012O

For interconnection see chapter „Circuit Diagrams“

3.1.6 Battery Rack 90 Ah





For interconnection see chapter „Circuit Diagrams“

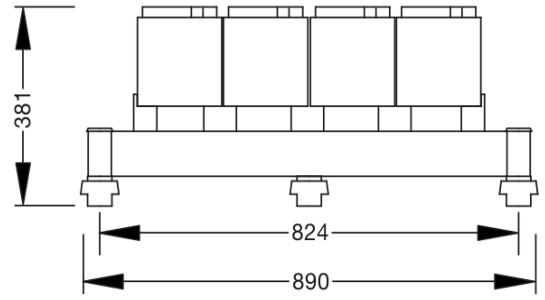
Technical Data

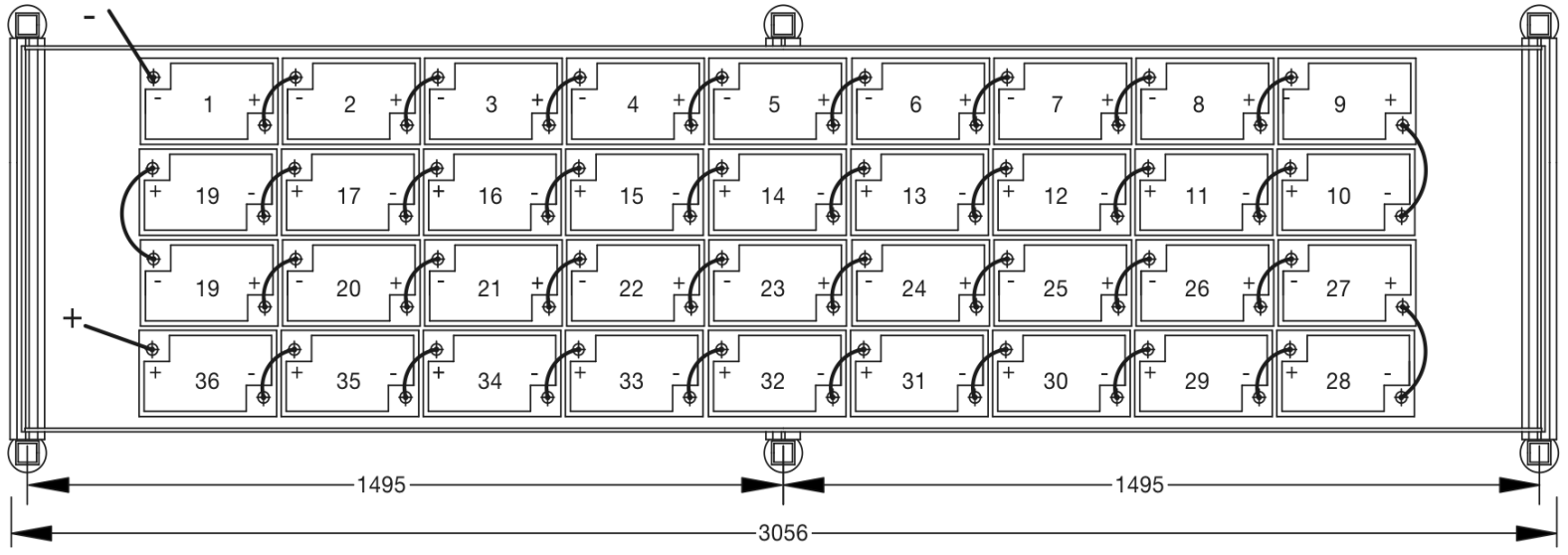
Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 90 Ah
Rated voltage of all batteries	216 V
Number of all batteries	18 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	660 kg
Dimensions in mm (W x H x D)	2456 x 1797 x 690
Order no. of battery bloc	40066070465

Wiring Set 4 0071 346 809 included

No.	Length	Number
1	170 mm	13
2	360 mm	4

3.1.7 Battery Rack 126 Ah





For interconnection see chapter „Circuit Diagrams“

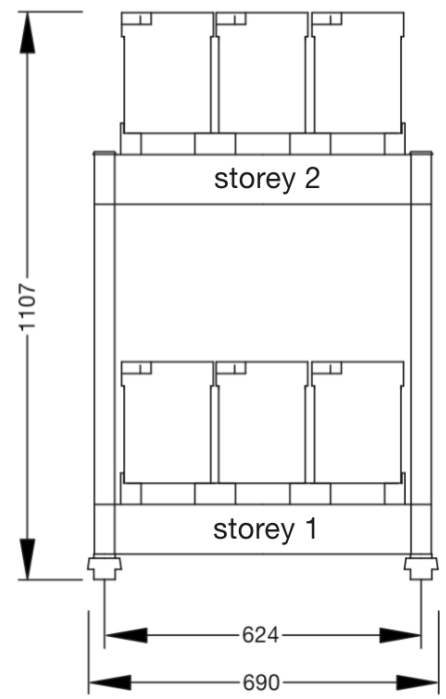
Technical Data

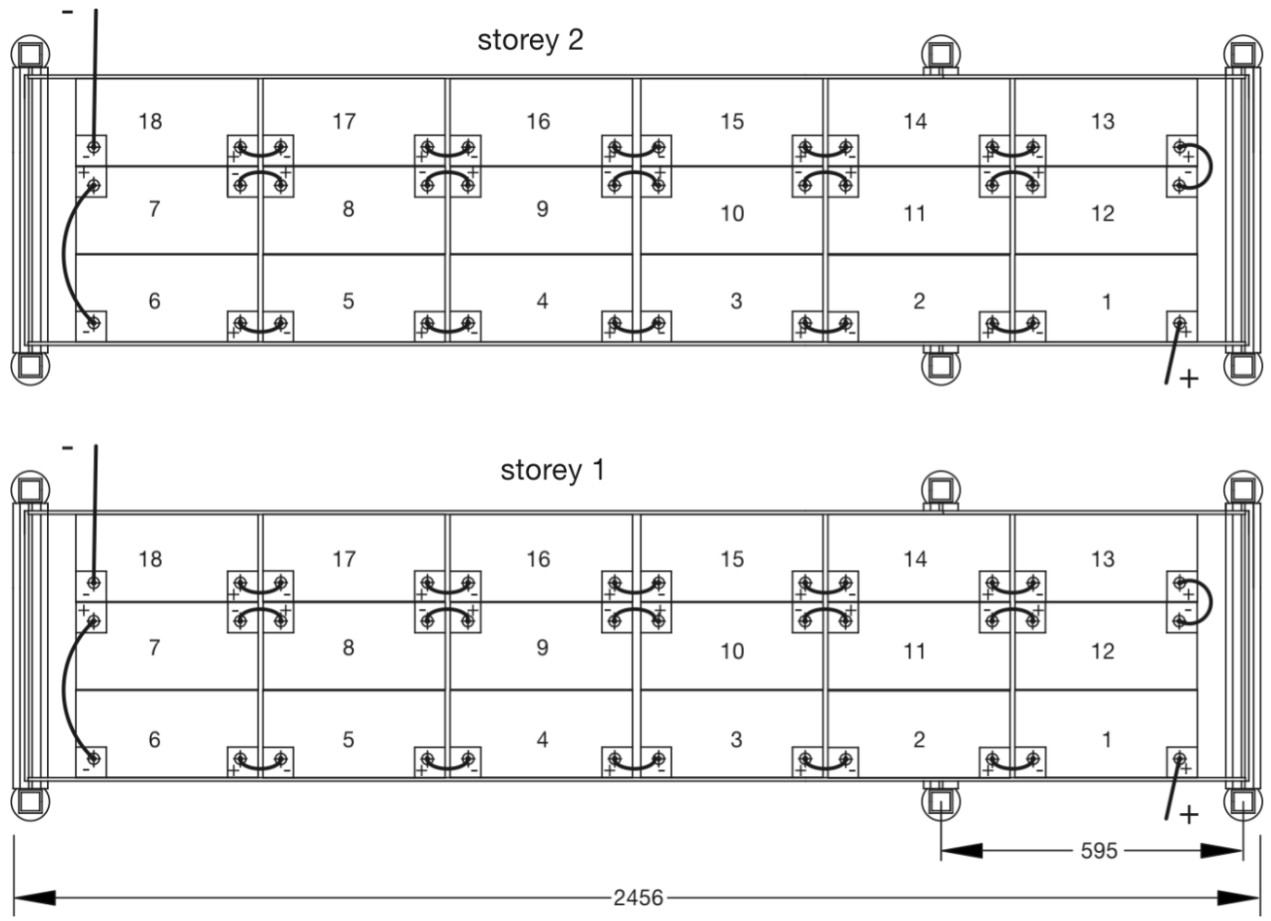
Type of battery (C10; 1.7 V/Z; +20 °C)	6 V / 126 Ah
Rated voltage of all batteries	216 V
Number of all batteries	36 á 6 V
Supply terminals	max. 35 mm²
Weight incl. batteries	3350 kg
Dimensions in mm (W x H x D)	3056 x 1261 x 890
Order no. of battery bloc	40066070466

Wiring Set 4 0071 346 811 included

No.	Length	Number
1	170 mm	32
2	250 mm	3

3.1.8 Battery Rack 166 Ah





For interconnection see chapter „Circuit Diagrams“

Battery Rack
166 Ah (2 x 83 Ah)

The battery racks 166 Ah will be built of two parallel connected racks 83 Ah by using the battery distribution panel (40071346700) according to mounting circuit diagram.

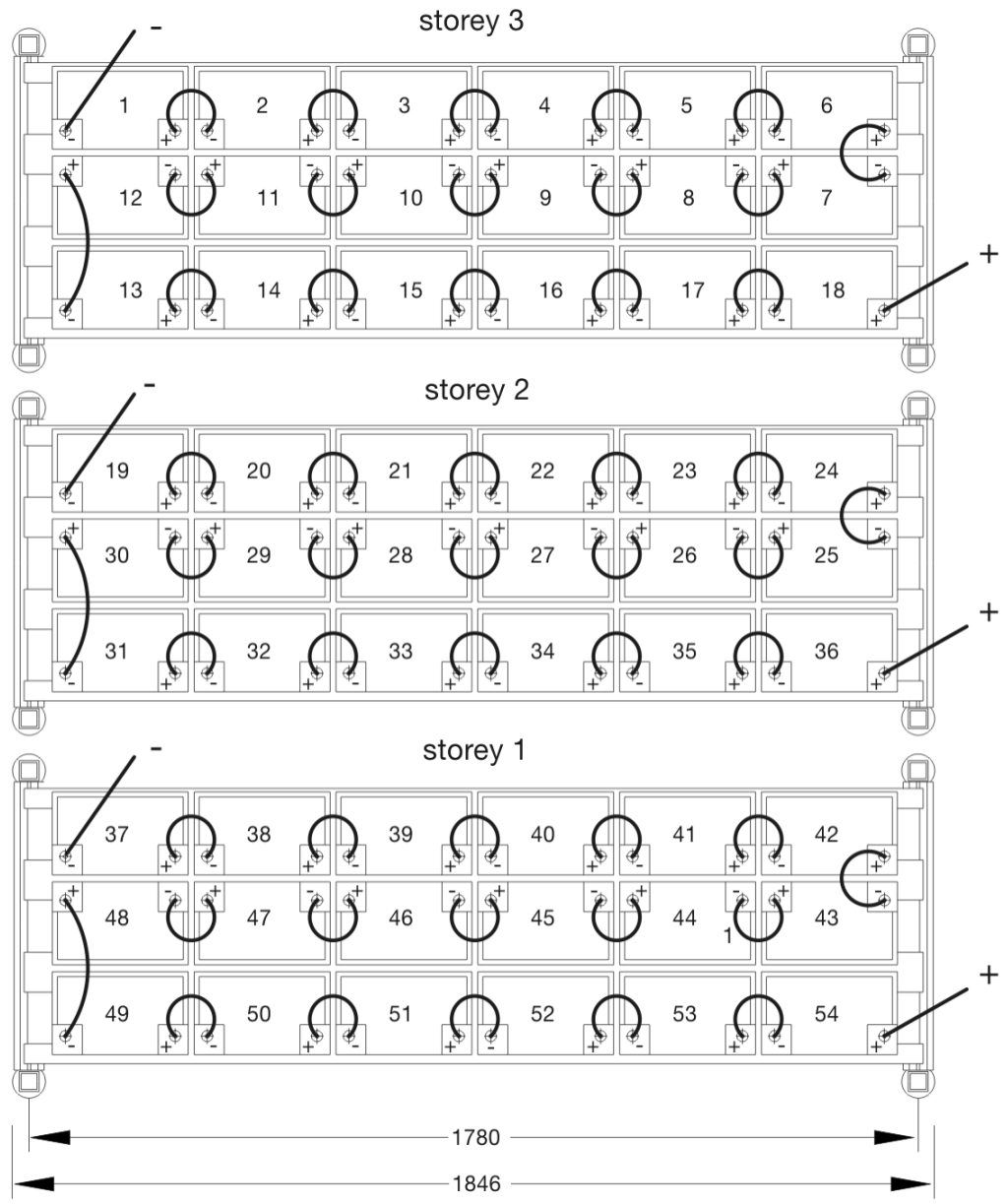
Technical Data

Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 83 Ah
Rated voltage of all batteries	216 V
Number of all batteries	36 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	1850 kg
Dimensions in mm (W x H x D)	2456 x 1107 x 690
Order no. of battery bloc	40066070120

Wiring Set 4 0071 346 812 included

No.	Length	Number
1	150 mm	32
2	360 mm	2

3.1.9 Battery Rack 189 Ah



For interconnection see chapter „Circuit Diagrams“

Battery Rack
189 Ah (3 x 63 Ah)

The battery racks 189 Ah will be built of three parallel connected racks 63 Ah by using the battery distribution panel (40071346701) according to mounting circuit diagram.

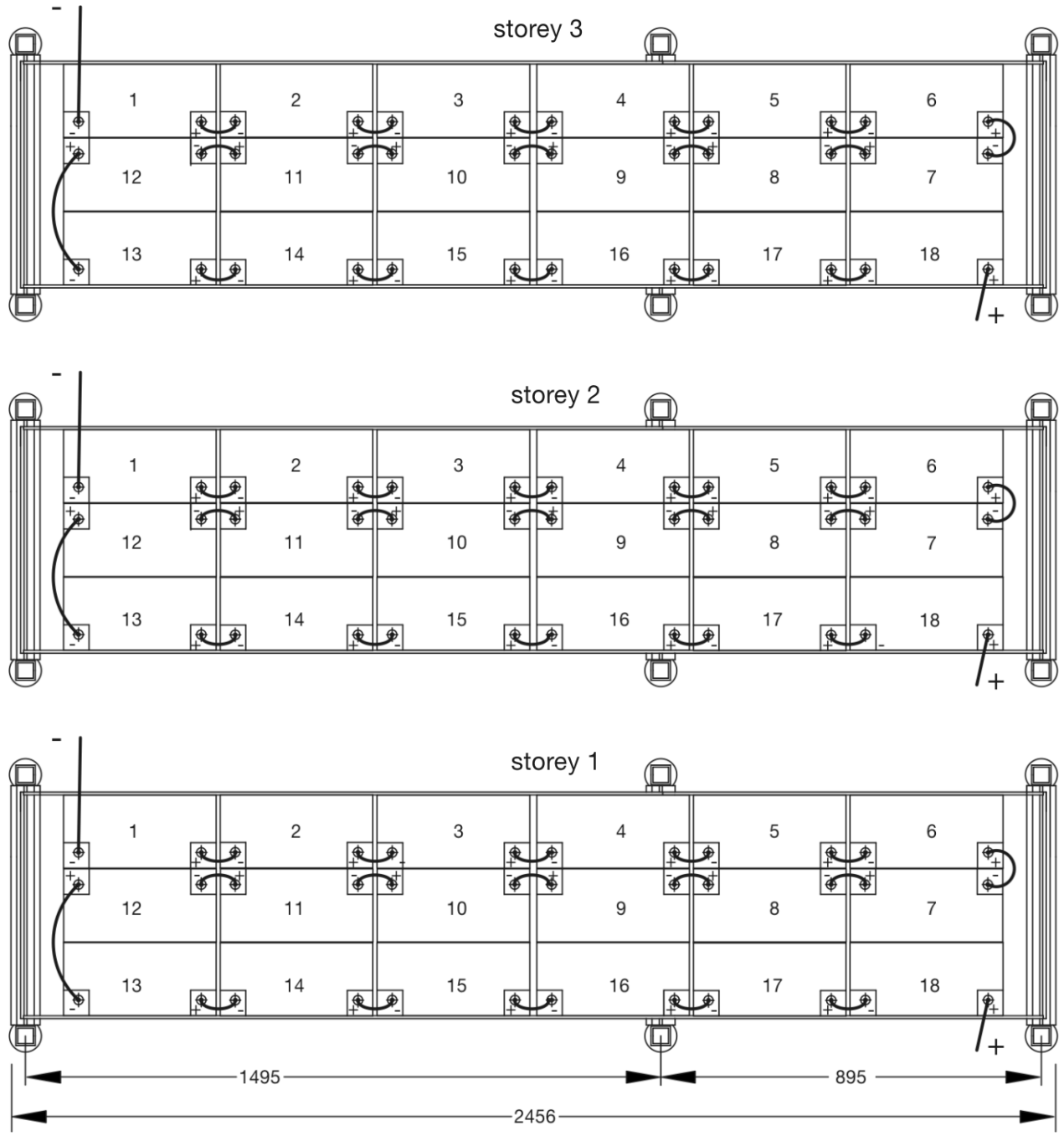
Technical Data

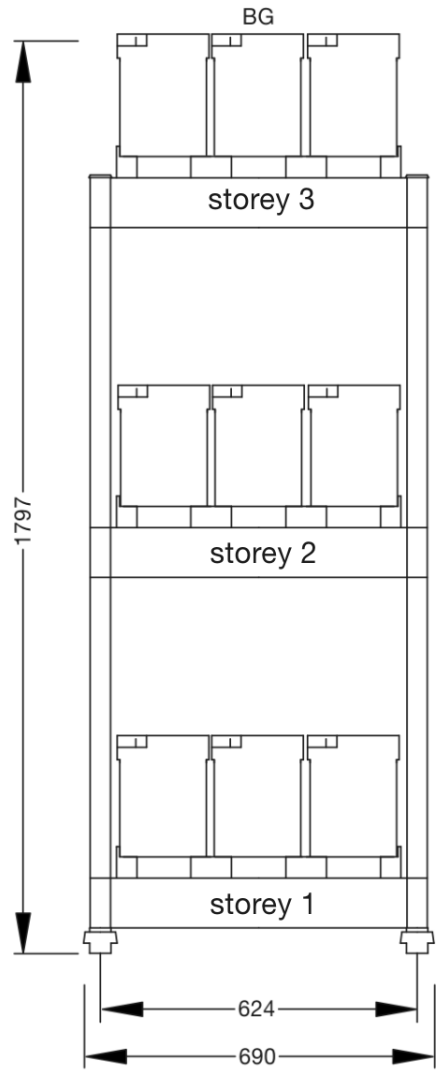
Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 63 Ah
Rated voltage of all batteries	216 V
Number of all batteries	54 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	1440 kg
Dimensions in mm (W x H x D)	1846 x 1261 x 690
Order no. of battery bloc	40066070464

Wiring Set 4 0071 346 813 included

No.	Length	Number
1	100 mm	45
2	170 mm	3
3	400 mm	3

3.1.10 Battery Rack 249 Ah





For interconnection see chapter „Circuit Diagrams“

Battery Rack
249 Ah (3 x 83 Ah)

The battery racks 249 Ah will be built of three parallel connected racks 83 Ah by using the battery distribution panel (40071346701) according to mounting circuit diagram.

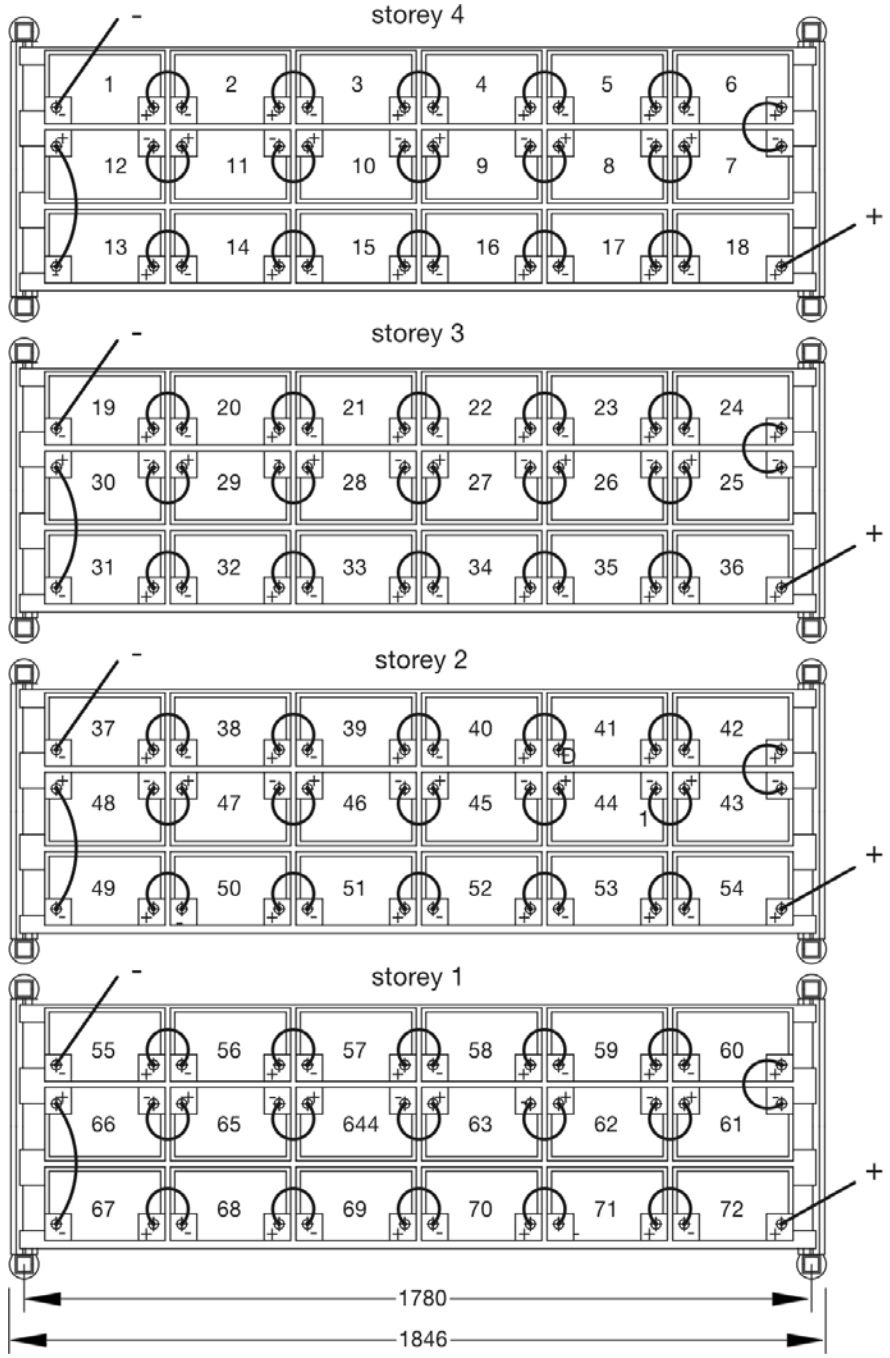
Technical Data

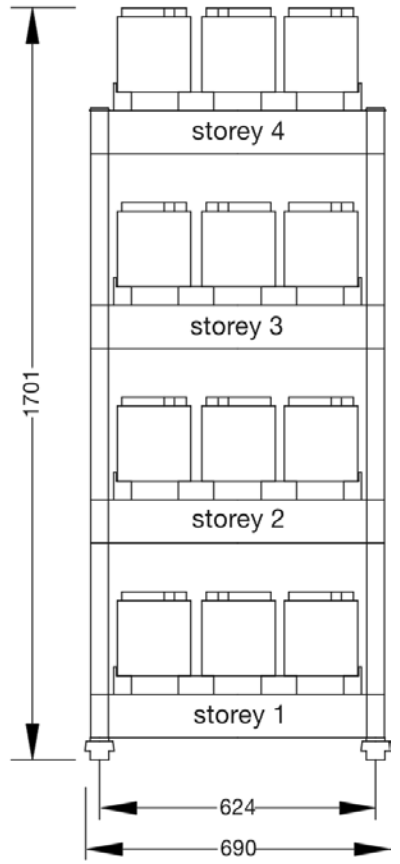
Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 83 Ah
Rated voltage of all batteries	216 V
Number of all batteries	54 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	1850 kg
Dimensions in mm (W x H x D)	2456 x 1797 x 690
Order no. of battery bloc	40066070120

Wiring Set 4 0071 346 814 included

No.	Length	Number
1	150 mm	48
2	360 mm	3

3.1.11 Battery Rack 252 Ah





For interconnection see chapter „Circuit Diagrams“

Battery Rack
252 Ah (4 x 63 Ah)
The battery racks 252 Ah will be built of three parallel connected racks 63 Ah by using the battery distribution panel (40071346702) according to mounting circuit diagram.

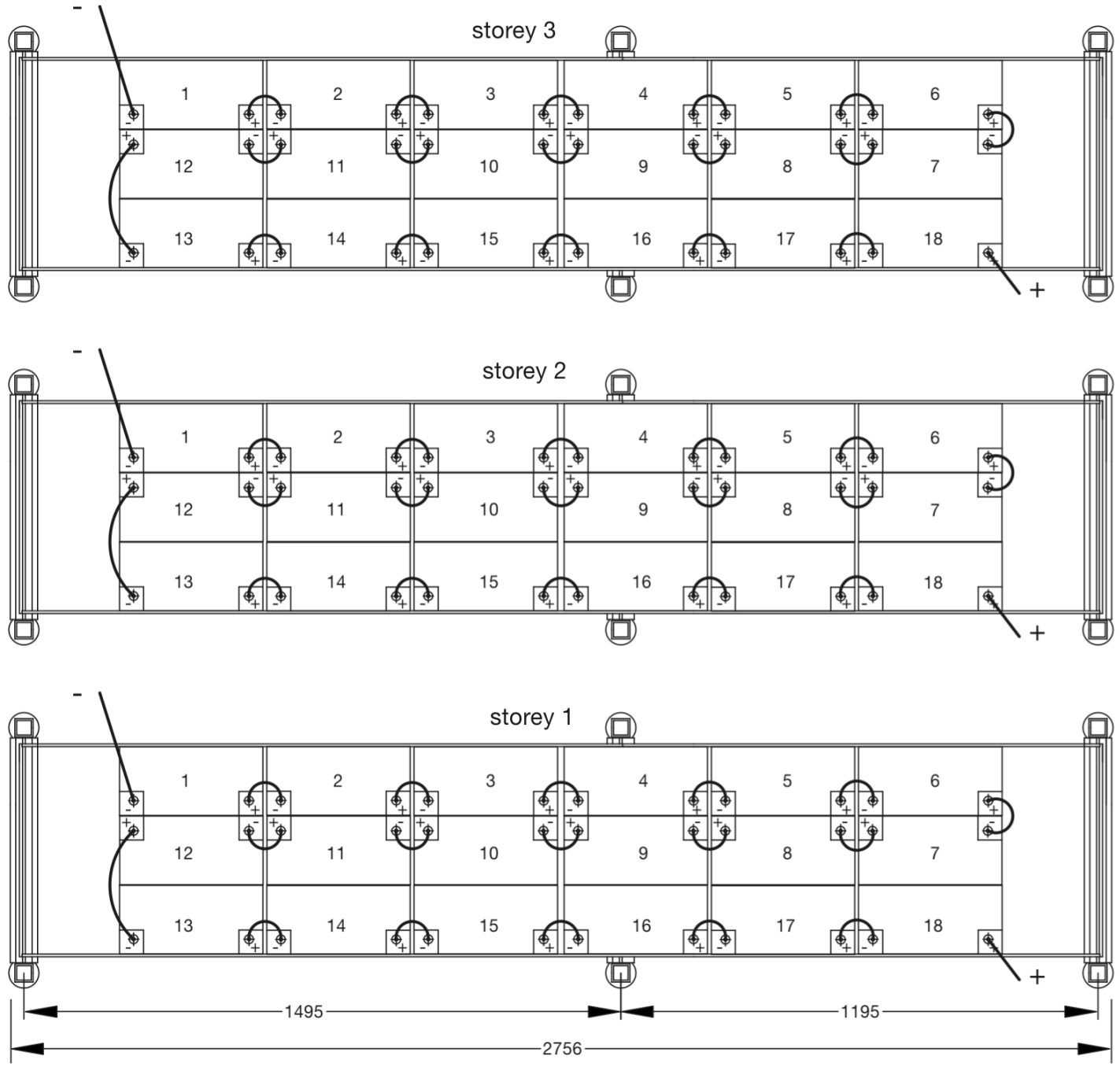
Technical Data

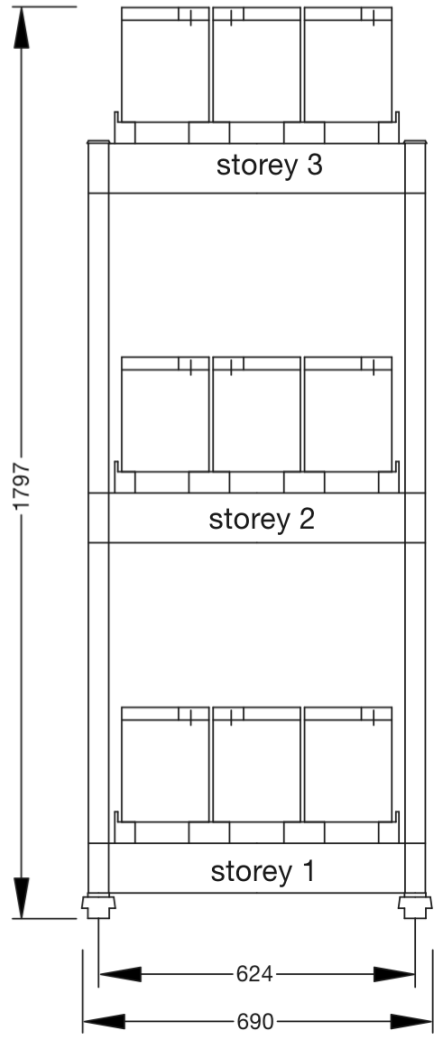
Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 63 Ah
Rated voltage of all batteries	216 V
Number of all batteries	72 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	1920 kg
Dimensions in mm (W x H x D)	1846 x 1701 x 690
Order no. of battery bloc	40066070464

Wiring Set 4 0071 346 815 included

No.	Length	Number
1	300 mm	64
2	440 mm	4

3.1.12 Battery Rack 270 Ah





For interconnection see chapter „Circuit Diagrams“

Battery Rack
270 Ah (3 x 90 Ah)

The battery racks 270 Ah will be built of three parallel connected racks 90 Ah by using the battery distribution panel (40071346701) according to mounting circuit diagram.

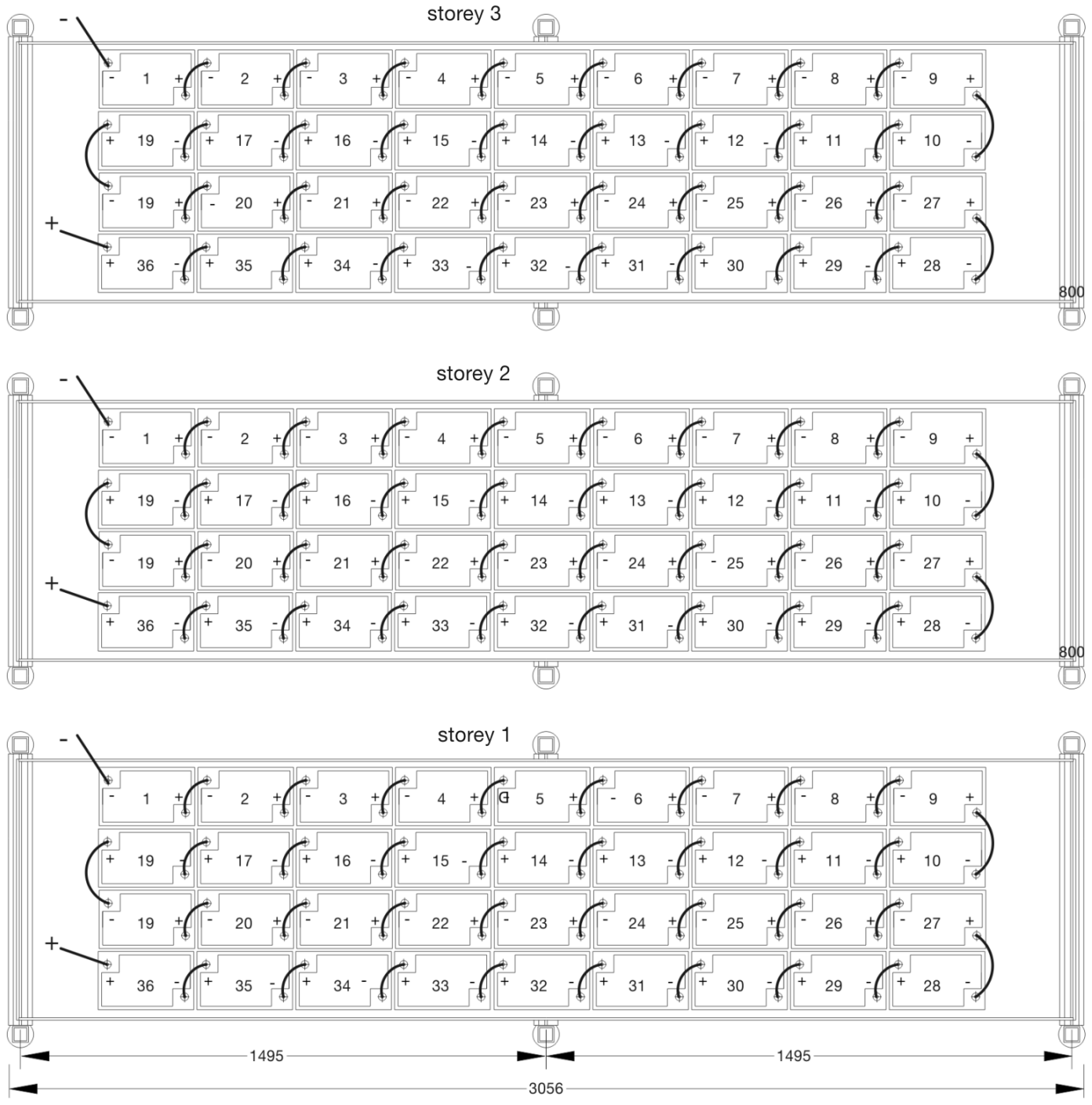
Technical Data

Type of battery (C10; 1.7 V/Z; +20 °C)	12 V / 90 Ah
Rated voltage of all batteries	216 V
Number of all batteries	54 á 12 V
Supply terminals	max. 35 mm²
Weight incl. batteries	1995 kg
Dimensions in mm (W x H x D)	2756 x 1811 x 690
Order no. of battery bloc	40066070465

Wiring Set 4 0071 347 660 included

No.	Length	Number
1	230 mm	45
2	120 mm	3
3	280 mm	3

3.1.13 Battery Rack 378 Ah



For interconnection see chapter „Circuit Diagrams“

Battery Rack
378 Ah (3 x 126 Ah)

The battery racks 378 Ah will be built of three parallel connected racks 126 Ah by using the battery distribution panel (40071346701) according to mounting circuit diagram.

Technical Data

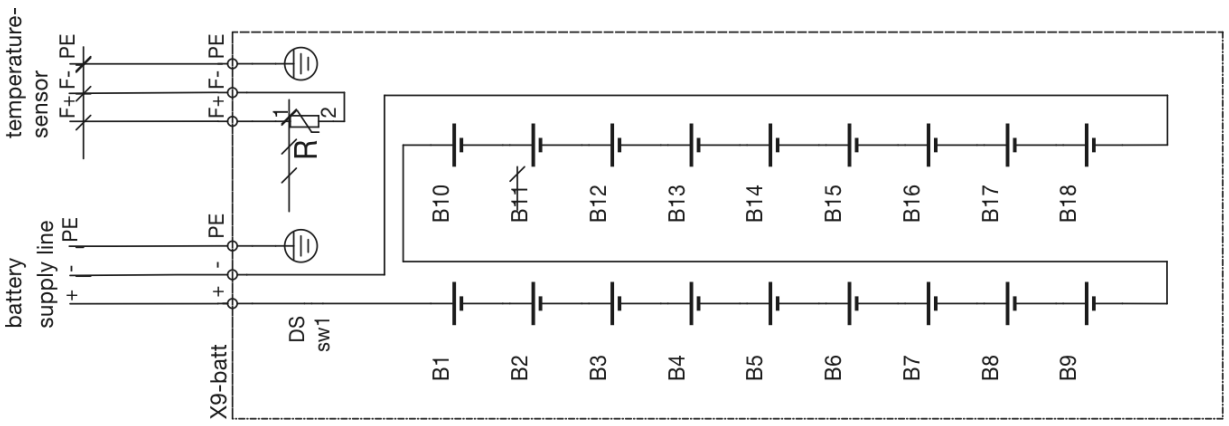
Type of battery (C10; 1.7 V/Z; +20 °C)	6 V / 126 Ah
Rated voltage of all batteries	216 V
Number of all batteries	108
Supply terminals	max. 35 mm²
Weight incl. batteries	3000 kg
Dimensions in mm (W x H x D)	3056 x 1261 x 890
Order no. of battery bloc	40066070466

Wiring Set 4 0071 346 817 included

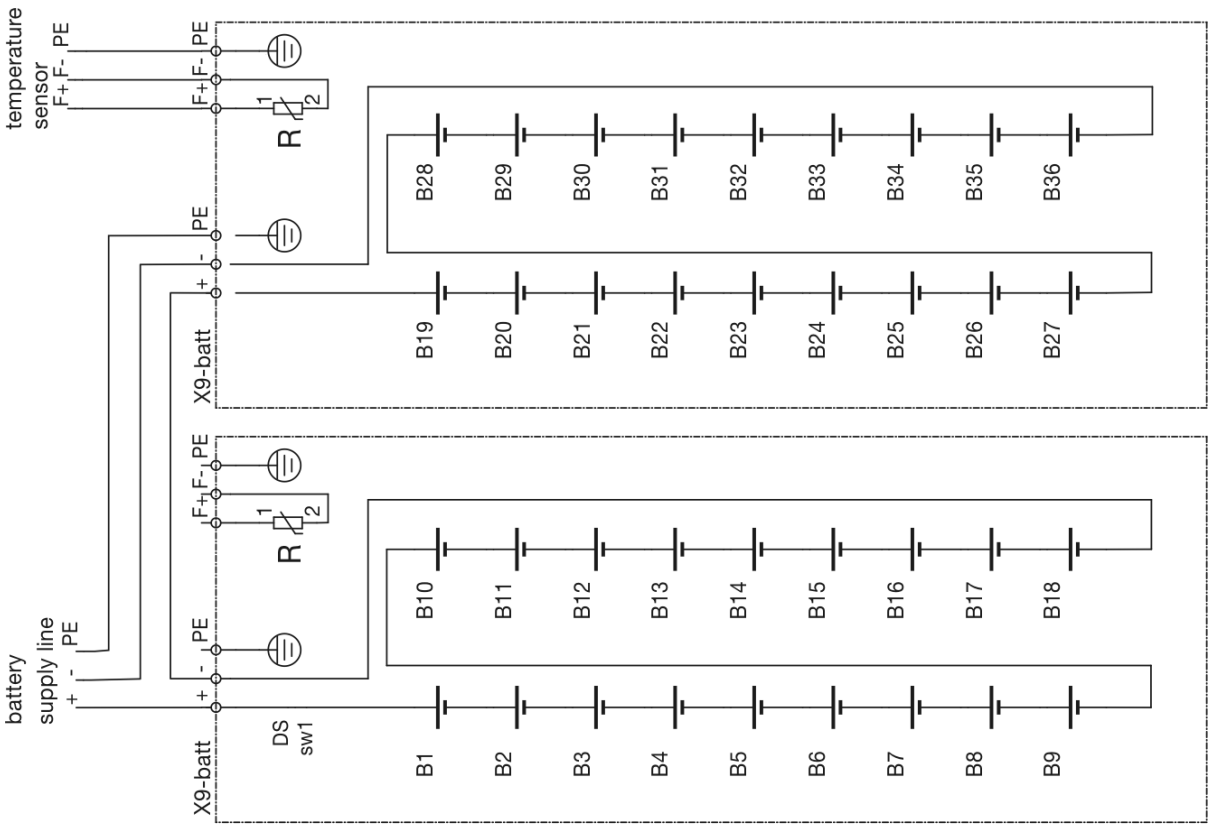
No.	Length	Number
1	170 mm	96
2	250 mm	9

4 Circuit Diagrams

4.1 Wiring 5.5 Ah to 90 Ah



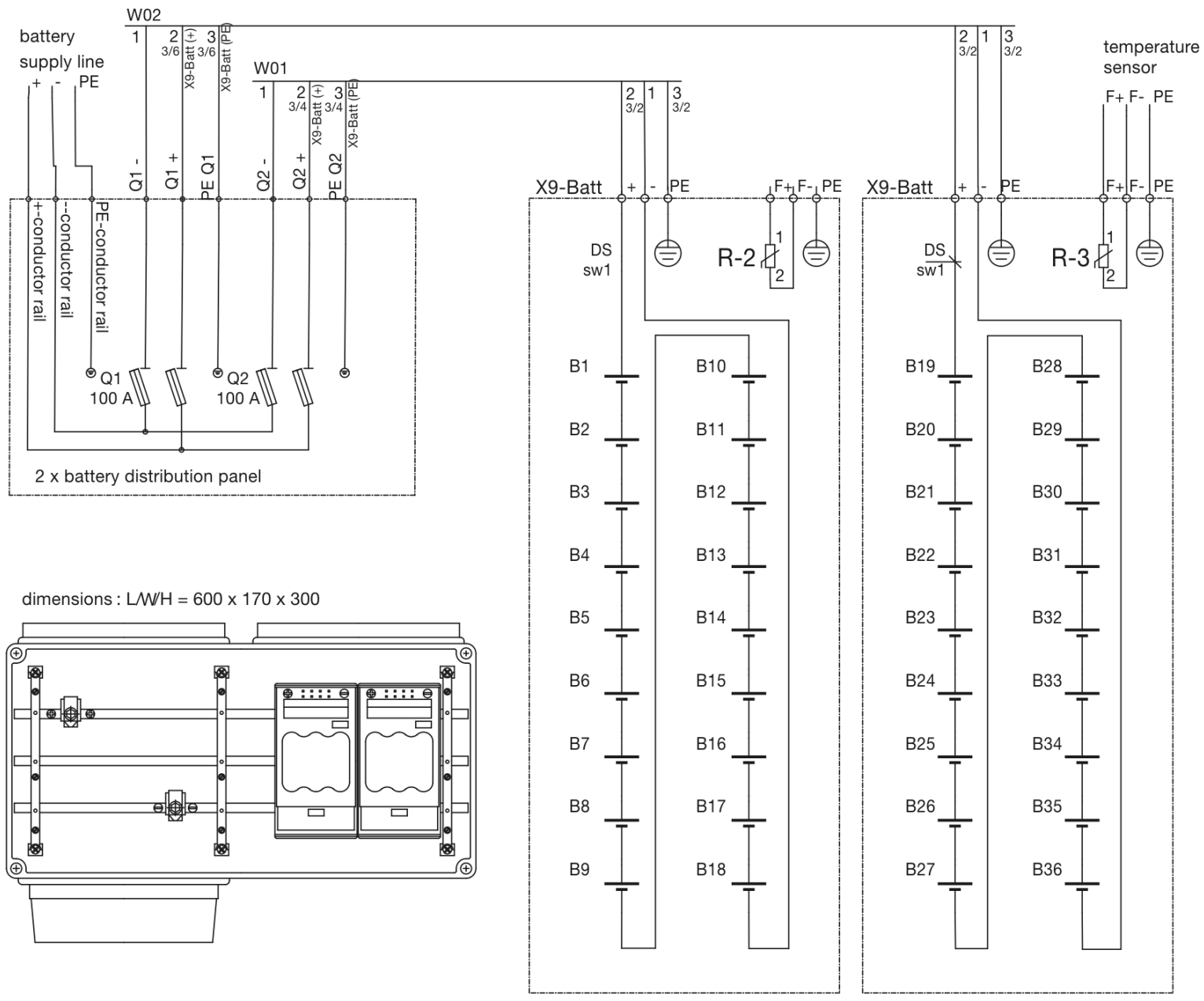
4.2 Wiring 126 Ah



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 Verdrahtung 166 Ah



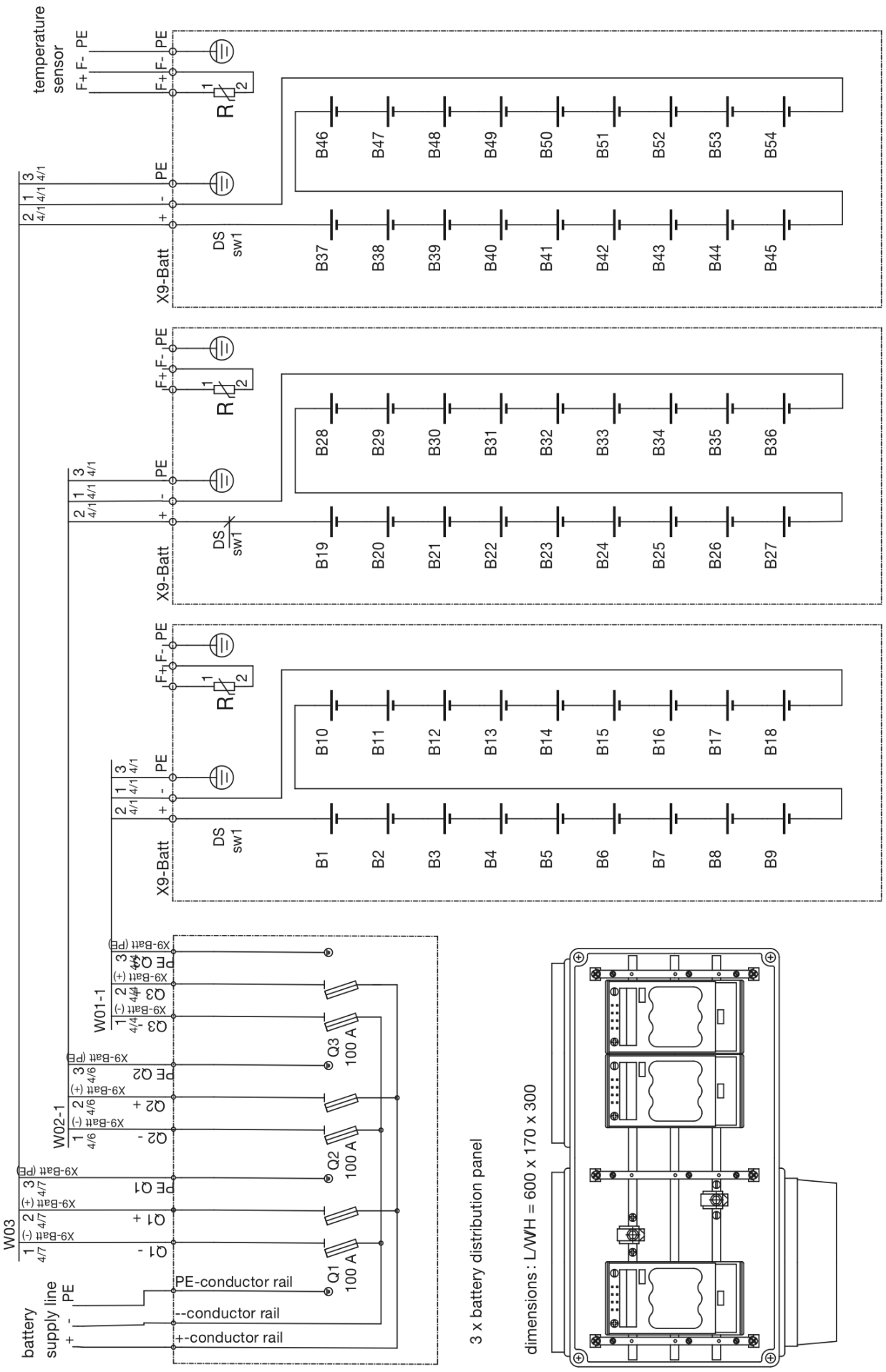
dimensions : L/W/H = 600 x 170 x 300

Battery Distribution Panel
see separate Installation instructions 30080001443(A)

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.

4.4 Wiring 189 Ah

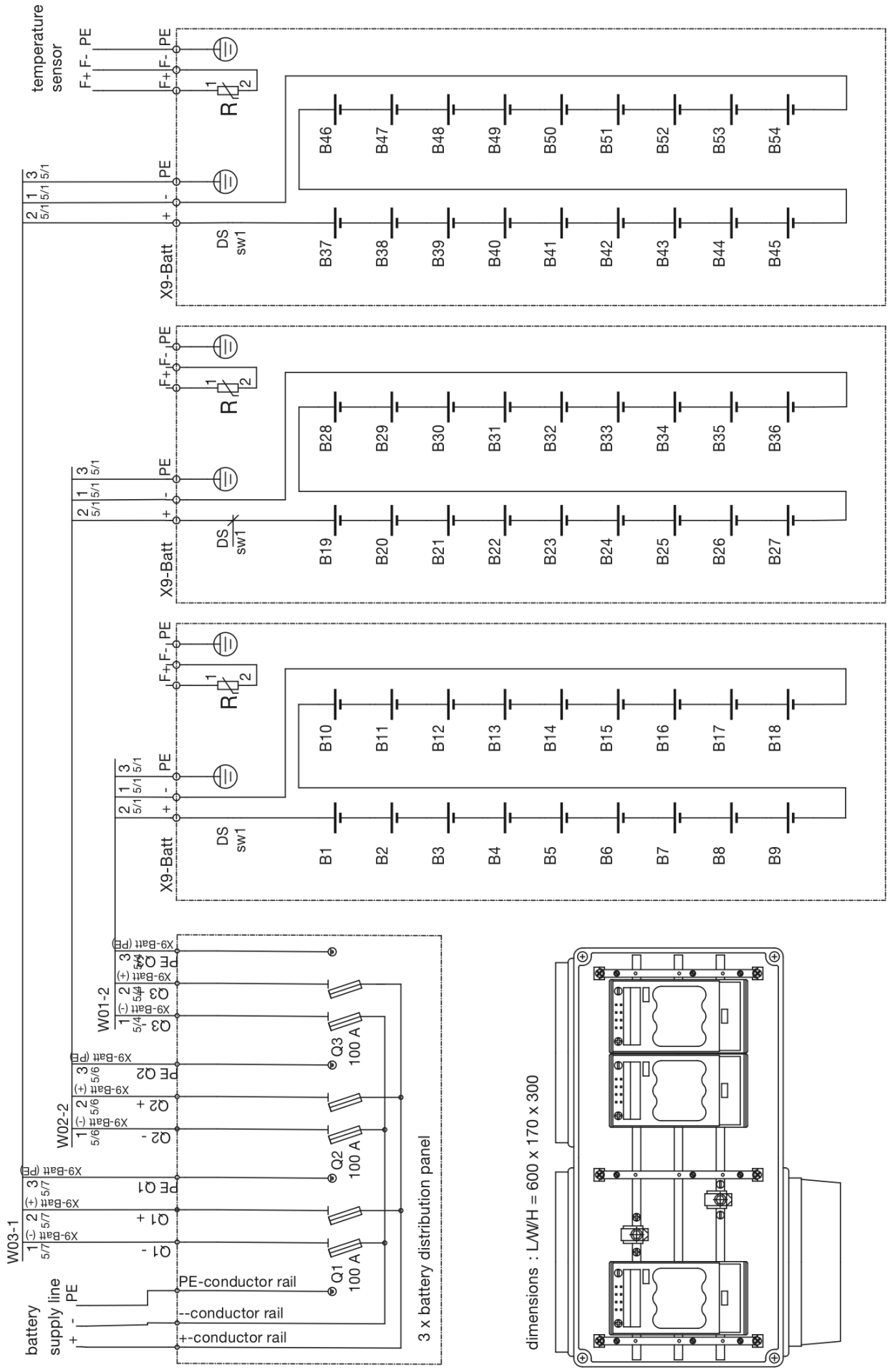


3 x battery distribution panel

Battery Distribution Panel
see separate Installation instructions 3008001443(A)

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.

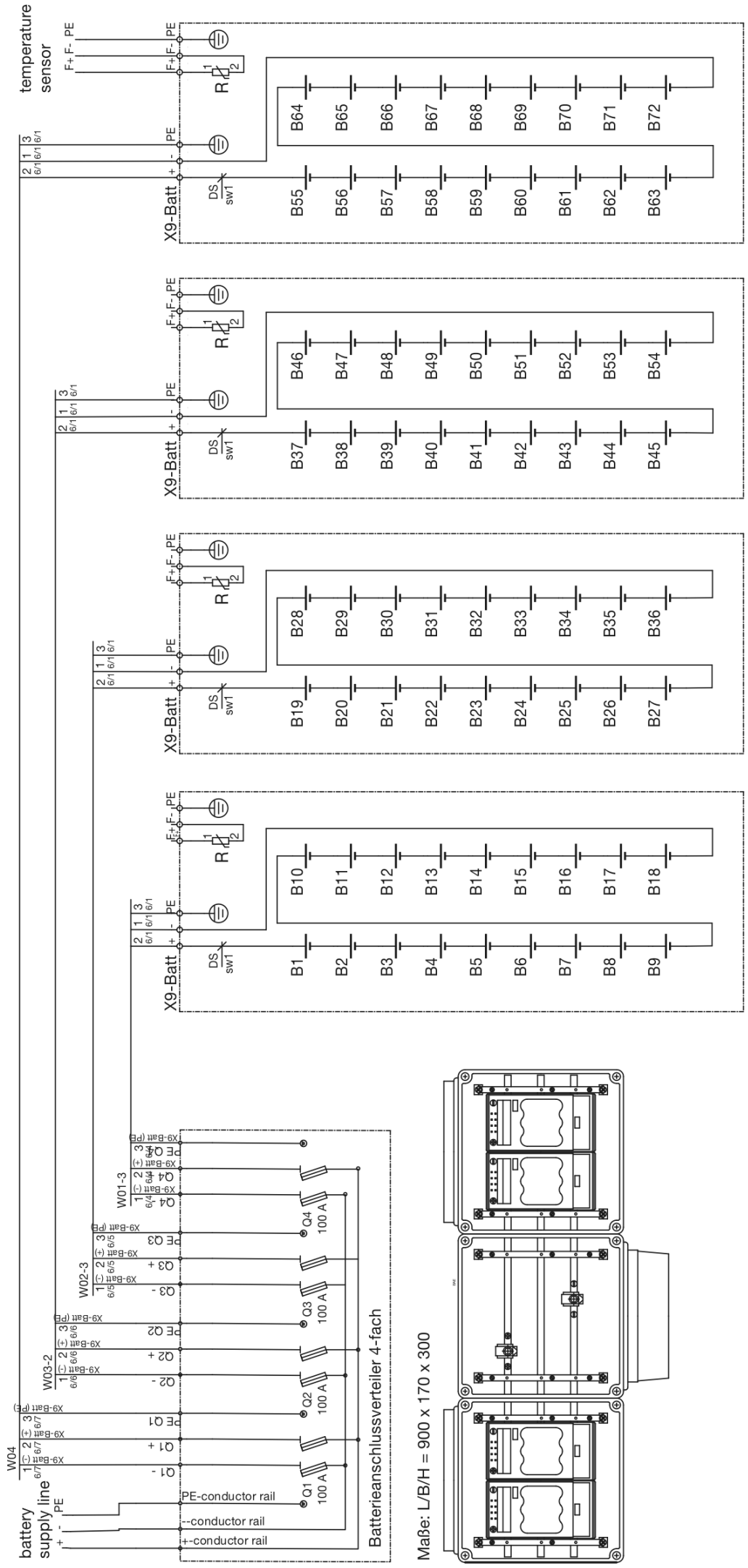
4.5 Wiring 249 Ah



Battery Distribution Panel
see separate Installation instructions 3008001443(A)

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.

4.6 Wiring 252 Ah



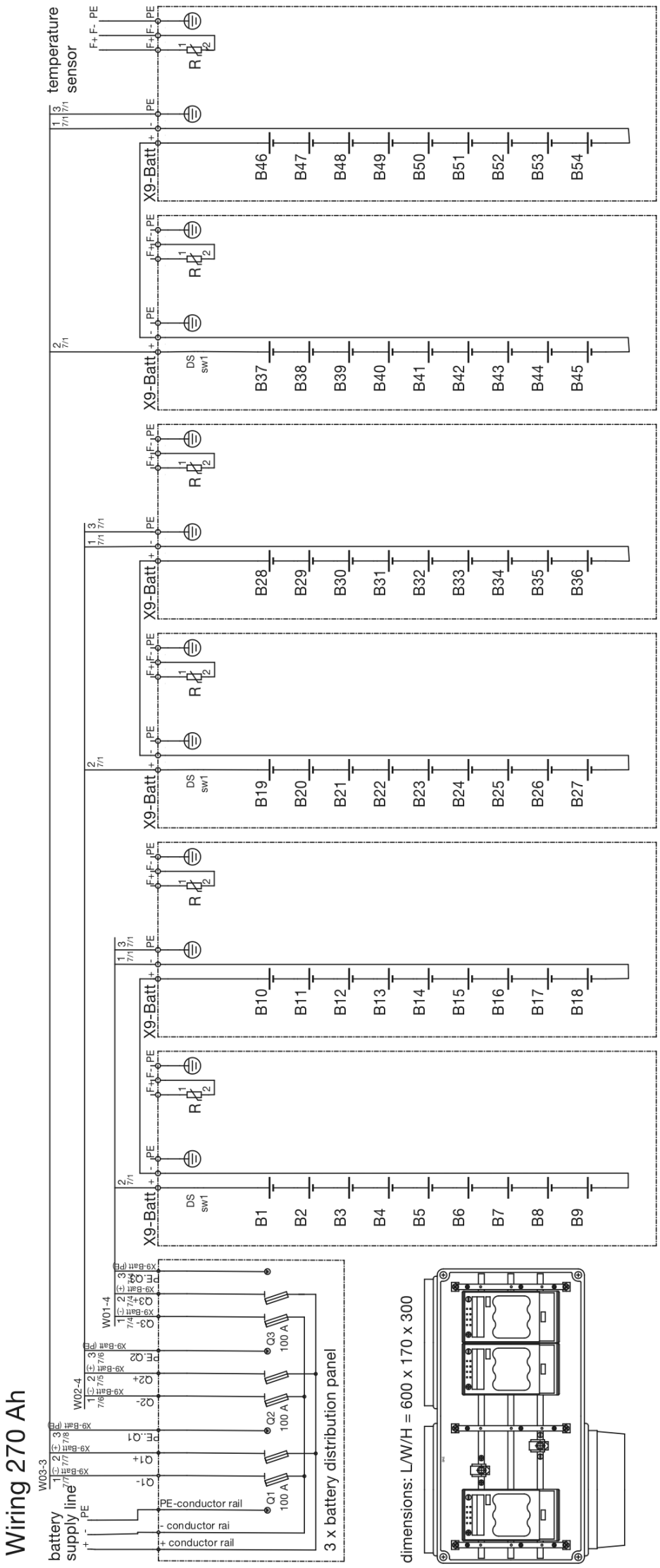
Maße: L/B/H = 900 x 170 x 300

Battery Distribution Panel
see separate Installation instructions 3008001443(A)

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.

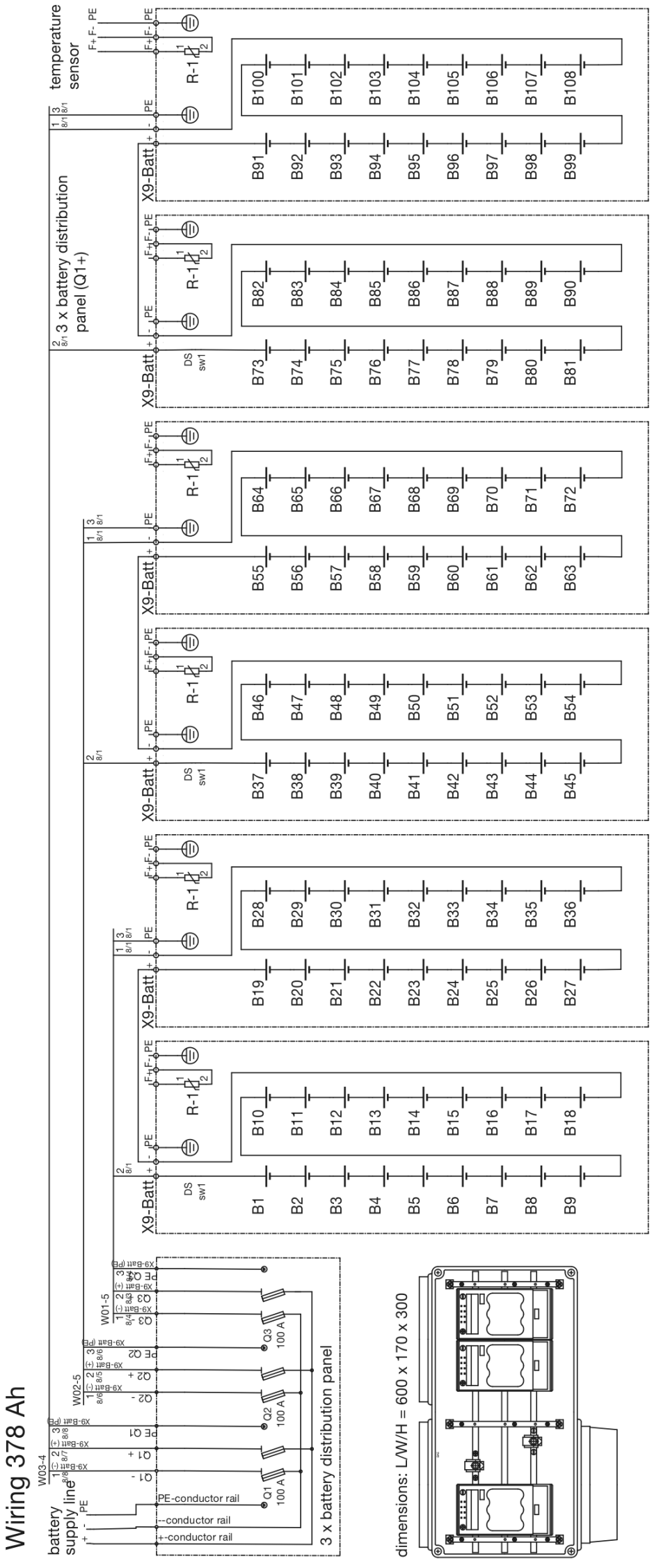
4.7 Wiring 270 Ah



Battery Distribution Panel
see separate Installation instructions 3008000144 3(A)

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.

4.8 Wiring 378 Ah



Battery Distribution Panel
see separate Installation instructions 300800014 43(A)

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.

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.

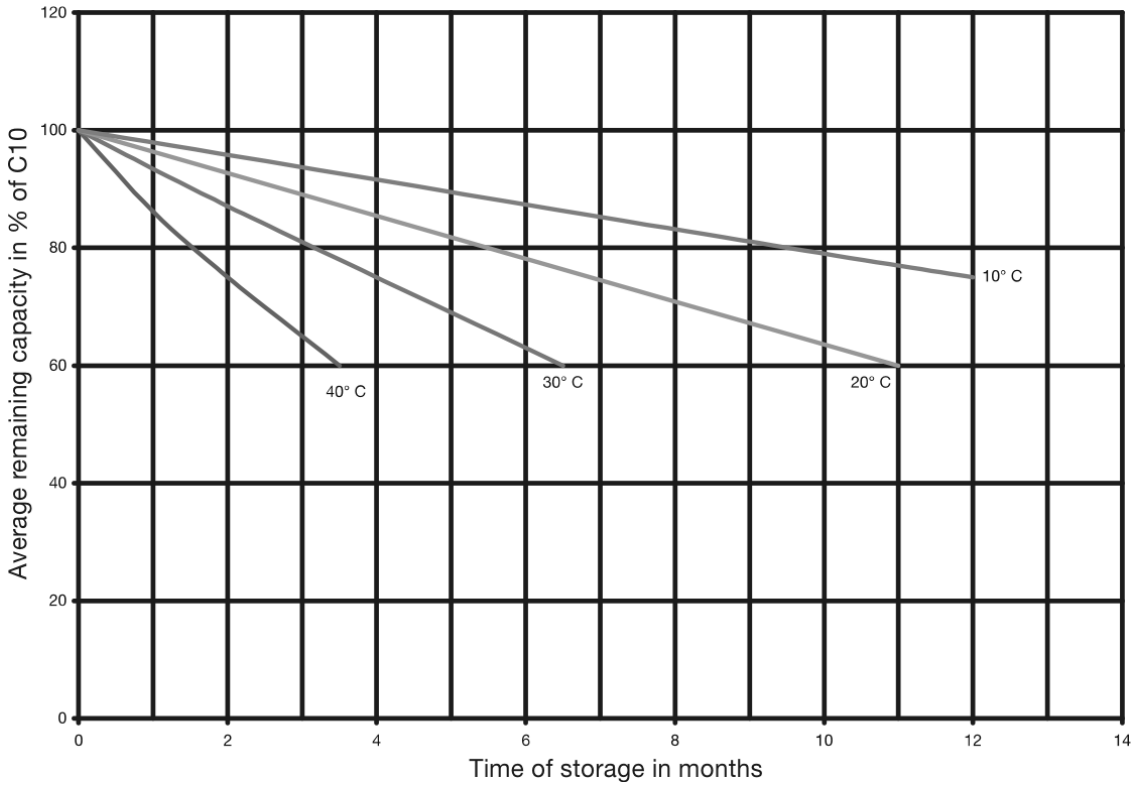


Fig. 1: Sprinter – remaining capacity in % of C10 versus time of storage with different temperatures

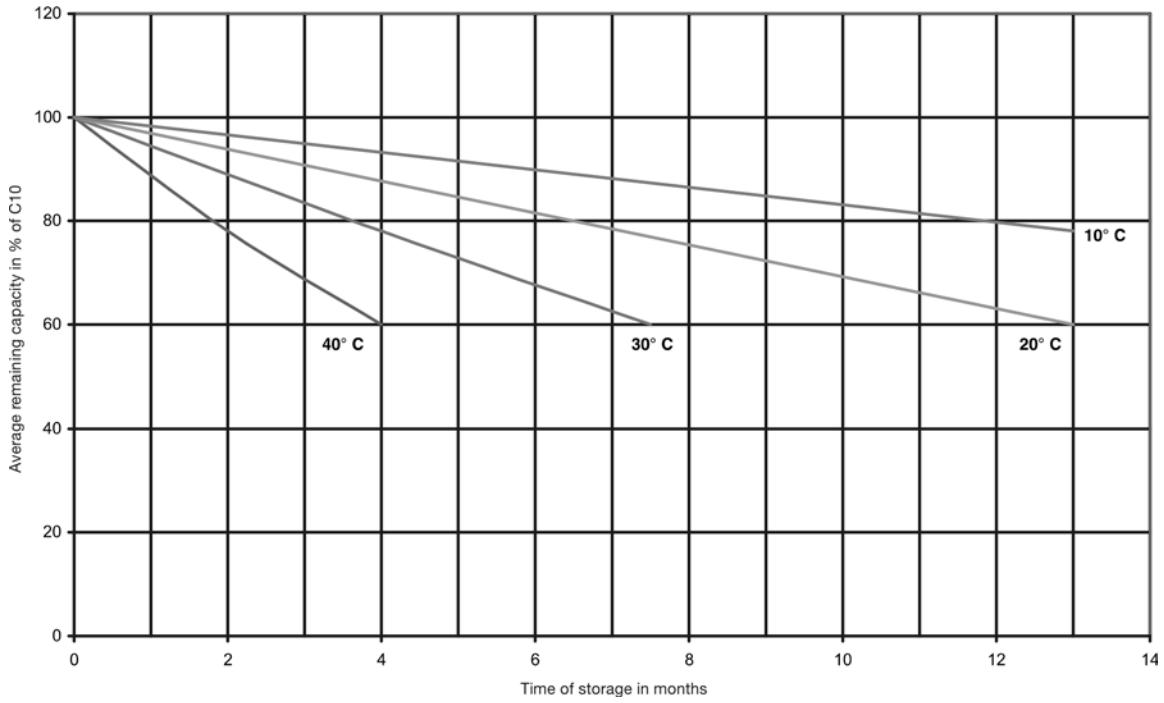


Fig. 2: Marathon – remaining capacity in % of C10 versus time of storage with different temperatures

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).

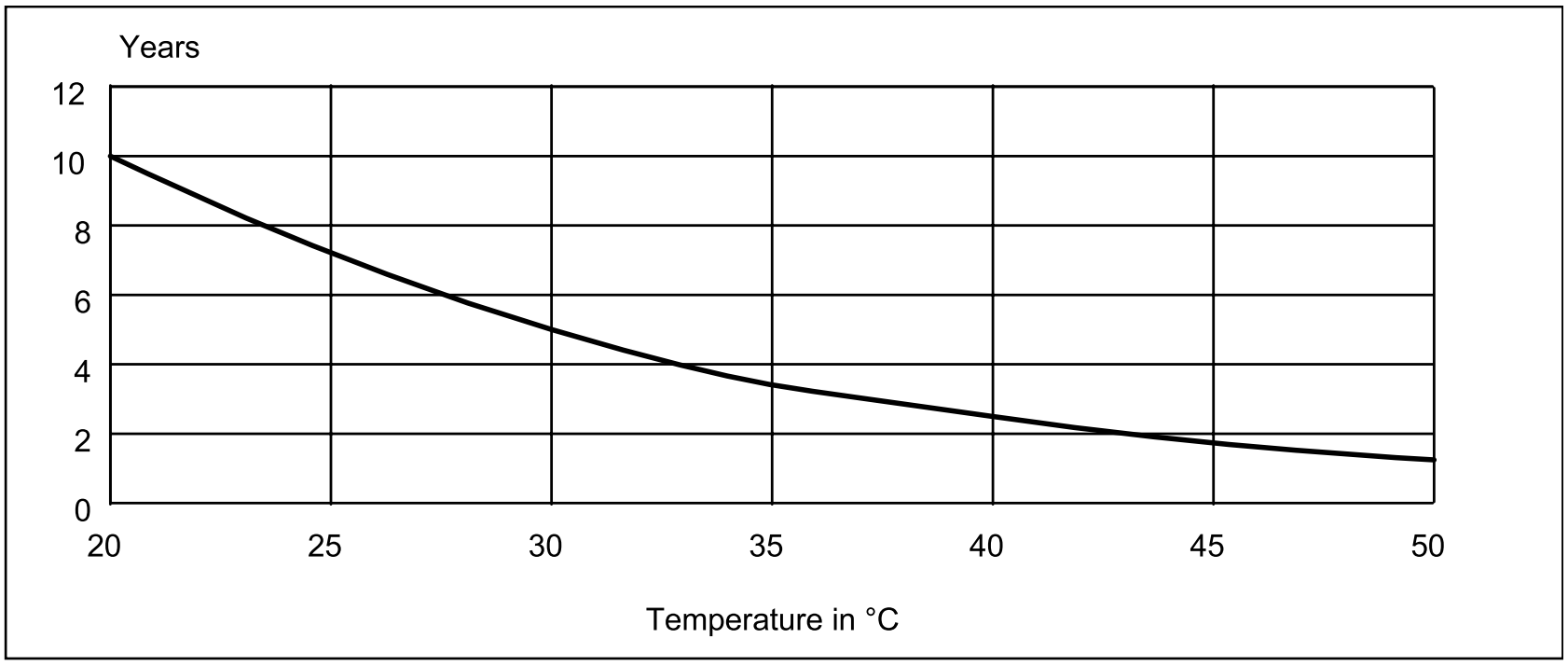


Fig. 1: Sprinter – Life utility versus temperature

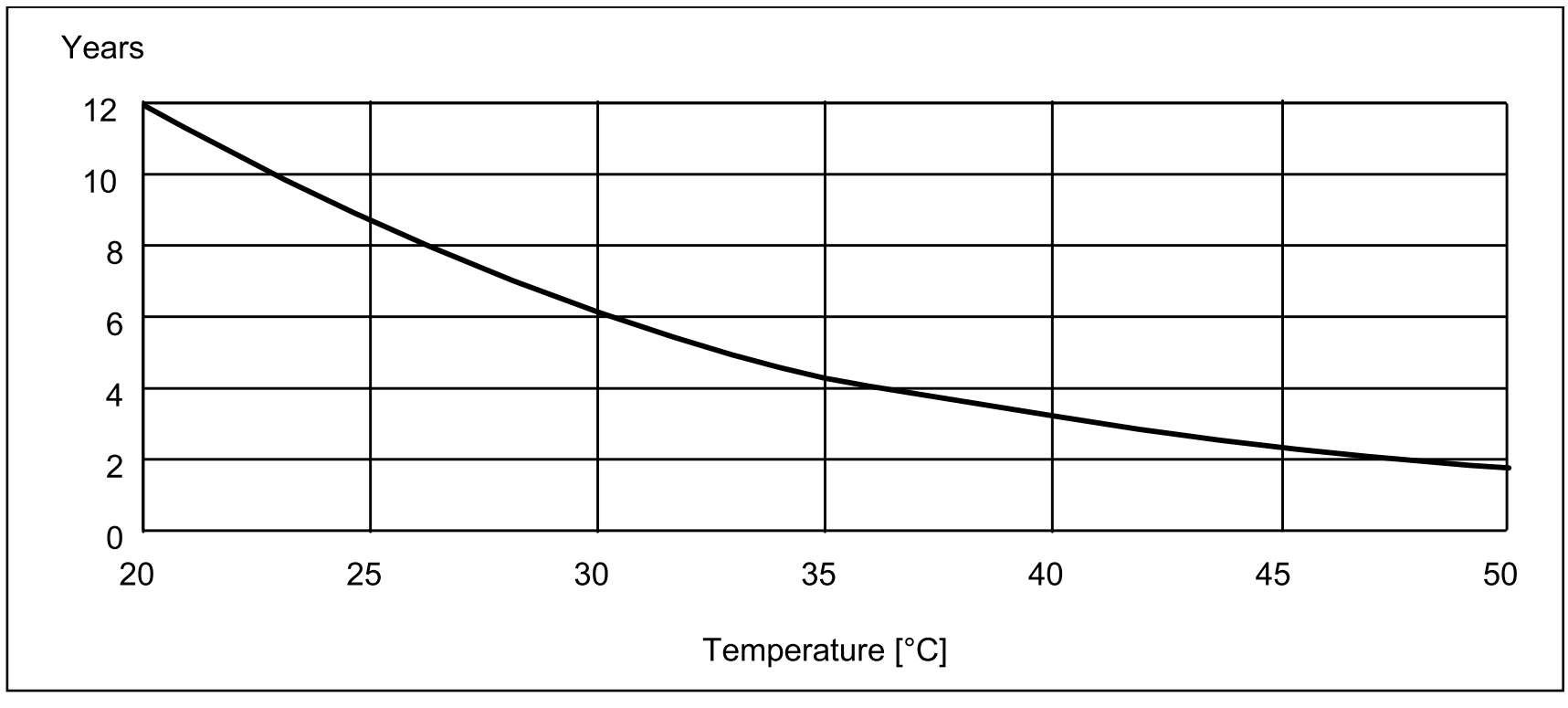


Fig. 2: Marathon – Life utility versus temperature

6.2.2 Room dimensions and Surface conditions

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

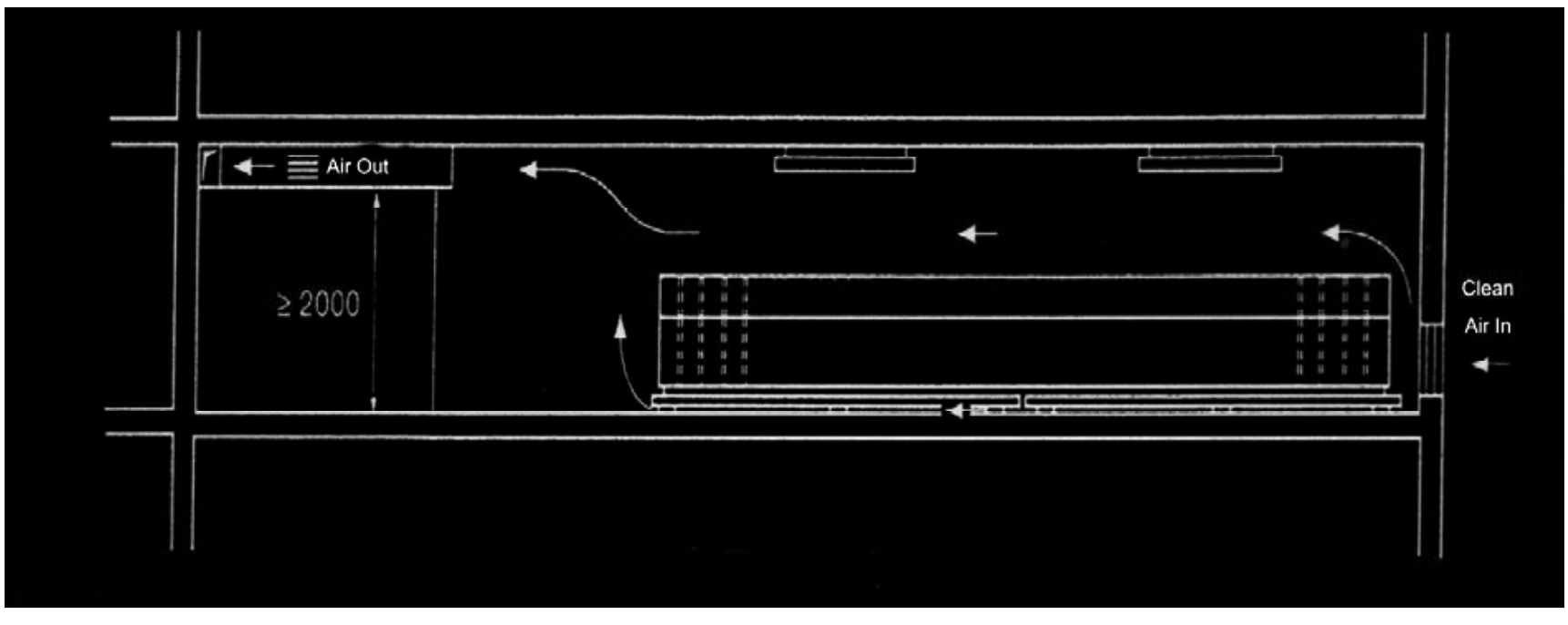
From EN 50272-2: "...The floor area for a person standing within arm´s reach of the battery shall be electrostatic dissipative in order to prevent electrostatic charge generation. The resistance to a groundable point measured to IEC 61340-4-1 shall be less than 10 MOhm.

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:
$Q = 0.05 \times n \times I_{gas} \times CN \times 10^{-3}$ 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	5.5	8.5	12	22	33	53	57	63	83	90	126	166	189	249	252	270	378
Air volume flow req. for the ventilation of the place of installation [m³/h]	0.24	0.37	0.52	0.95	1.43	2.30	2.46	2.72	3.57	3.88	5.44	8.04	8.16	10.76	10.90	11.66	16.33
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	26.61	39.92	64.11	68.95	76.20	100.40	108.86	152.41	224.98	228.61	301.20	304.82	326.60	457.23

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 mm²/100 Ah string capacity.
- The end-connector cables must be placed on a copper bar with at least 100 mm²/100 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.

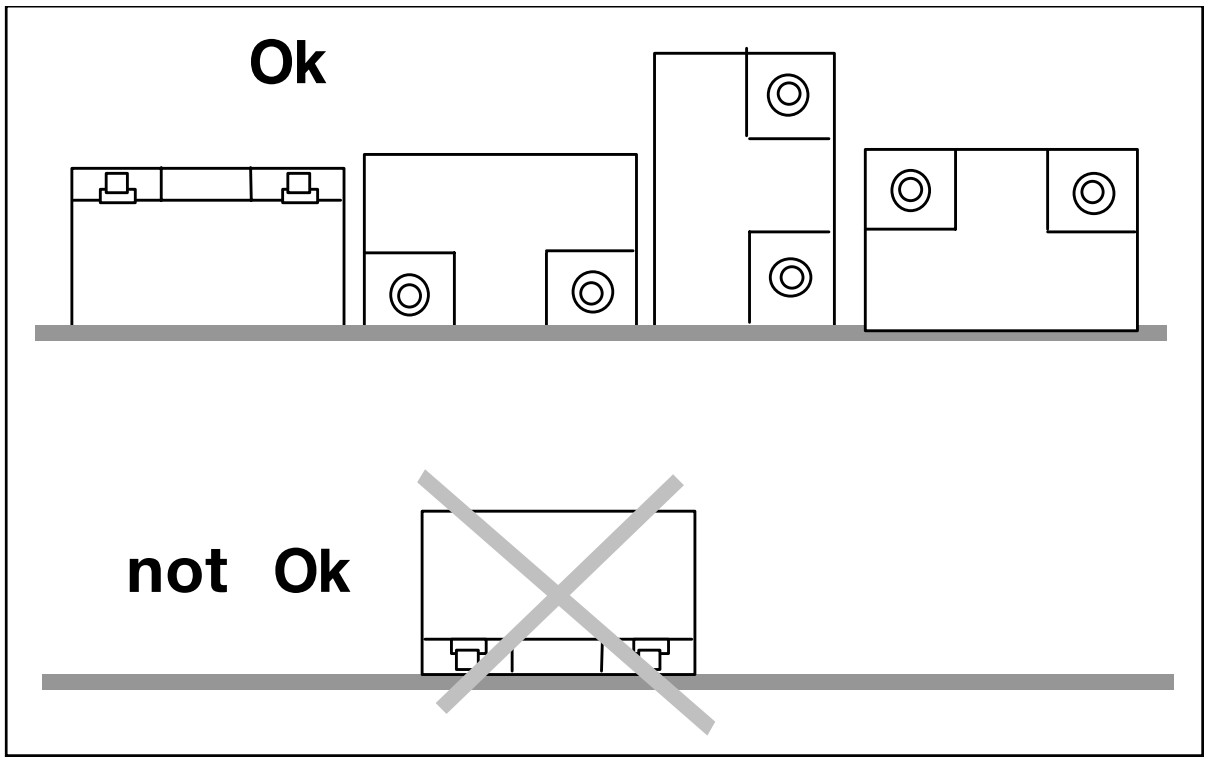


fig. 3: operation positions for AGM monoblocs

7 Commissioning

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

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!

35 0 35340 10

Installation instruction
for stationary lead acid batteries (Batteries / Stands / Cabinets)

- 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 50 272-2, DIN 50110-1.

- An acid splash on the skin or in the eyes must be flushed with plenty of clean 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 the contact with the electolyte is impossible. If the cell or monobloc container is damaged do not touch the exposed electrolyte because it is corrosive.

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

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

OPzS-cells	DIN 40736	2.08 ± 0.01 [Vpc]
OPzS-monobloc batt.	DIN 40737	2.08 ± 0.01 [Vpc]
OCSM-cells		2.10 ± 0.01 [Vpc]
GroE-cells	DIN 40738	2.06 ± 0.01 [Vpc]
OGi-monobloc batteries		2.10 ± 0.01 [Vpc]
OGi-cells	DIN 40734	2.10 ± 0.01 [Vpc]
OGiV-monobloc batt.	DIN 40741, part 1	2.10 ± 0.01 [Vpc]
Other OGiV-batteries monobloc	Depending on construction	2.08 - 2.14* [Vpc]
OPzV-cells	DIN 40742 (draft)	2.08 - 2.14* [Vpc]
OPzV-monobloc batt.	DIN 40744 (draft)	2.08 - 2.14* [Vpc]

* according to manufacturer's information

The open-circuit voltage of the individual cells must not vary from each other by more than 0.02 V. With regard to monobloc batteries, the maximum deviations of the open-circuit voltage are as follows:

4 V	monobloc batteries	0.03 V/bloc
6 V	monobloc batteries	0.04 V/bloc
12 V	monobloc batteries	0.05 V/bloc

Higher temperatures cause the open-circuit voltage to be lower, whereas lower temperatures cause it to be higher. At a deviation of 15 K from the nominal temperature, the open circuit-voltage changes by 0.01 Vpc. If the deviation is any higher, contact the supplier.

1. Installation preconditions and preparations

1.1
Prior to commencing installation, ensure that the battery room is clean and dry and that it has a lockable door. The battery room must meet the requirements in accordance with EN 50 272-2 and be marked as such. Pay attention to the following aspects:

– Load bearing capacity and nature of the floor (transport paths and battery room)
– Electrolytic resistance of the area where the battery is to be installed
– Ventilation

To ensure trouble free installation, coordination should be made with other personnel working in the same area.

1.2
Check delivery for complete and undamaged components. If necessary, clean all parts prior to installation.

1.3
Follow instructions in the documentation supplied (e.g. installation drawings for battery, stand, cabinet).

1.4
Prior to removing old batteries always ensure that all of the leads have been disconnected (load-break switches, fuses, insulations). This must be carried out only by personnel authorised to perform circuit operations.

<u>WARNING:</u> Do not carry out any unauthorised circuit operation!

1.5
Carry out open circuit voltage measurements on the individual cells or monobloc batteries. At the same time, ensure that they are connected in the correct polarity. As for unfilled and charged batteries, these measurements can only be taken after commissioning. The open-circuit voltages for fully charged cells at an electrolyte temperature of 20 °C are as follows:

2. Stands

2.1
Locate the stands/racks within the battery room in accordance with the installation plan. If an installation plan does not exist, observe the following minimum distances:

– From the wall: 100 mm all around, with regard to cells or monoblocs, or 50 mm, concerning of the stands.
– At a nominal voltage or partial voltage >120 V: 1.5 metres between non-insulated leads or connectors and grounded parts (e.g. water pipes) and/or between the battery terminals. During the installation of the batteries, ensure that EN 50 272-2 part 2 is observed (e.g. by covering electrically conductive parts with insulating mats).
– Width of aisles: 1.5 x cell width (built-in depth), but not less than 500 mm.

2.2
Balance battery stands horizontally, using the balance parts supplied, or adjustable insulators.

The distances of the base rails must correspond to the dimensions of the cells or monobloc batteries. Check the stands for stability and all screwed and clamped joints for firm connection. Earth (ground) the stand or parts of the stand, if required. Screwed joints must be protected against corrosion.

2.3
Check cells or monobloc batteries for perfect condition (visual check, polarity).

2.4
Place cells or monobloc batteries on the stand one after another, ensuring correct polarity. For large cells it is useful to start installing the cells in the middle of the stand:

- Align cells or monobloc batteries parallel to each other. Distance between cells or monobloc batteries approx. 10 mm, at least 5 mm.
- If necessary, clean the contacting surfaces of the terminals and connectors.
- Place and screw intercell or monobloc connectors, using an insulated torque wrench (for correct torque value refer to battery operating instructions). If applicable, observe special instructions with regard to the intercell connectors (e.g. welded connectors).
- Place the series, step or tier connectors supplied and screw them together, observing the given torque values.
- Avoid short circuits! Use leads of at least 3 kV breakdown voltage or keep an air distance of approx. 10 mm between the leads and electrically conductive parts, or apply additional insulation to the connectors. Avoid applying any mechanical force on the cell/battery poles.
- If applicable, remove transport plugs and replace by operational plugs.
- Check electrolyte level. (Observe operating instructions / commissioning instructions).
- Measure total voltage (nominal voltage: sum of open circuit voltages of the individual cells or monobloc batteries).
- If necessary sequentially number the cells or monobloc batteries in a visible place between the positive terminal of the battery and the negative terminal of the battery.
- Apply polarity signs for the battery leads.
- Attach safety marking, type lable and operating instructions in a visible place.
- If necessary, fit insulating covers for cell / monobloc connectors and terminals.

3. Cabinets

3.1
Cabinets with **built-in** battery:

- Install the battery cabinet at the location assigned, observing the accident prevention rules.
- Leave additional space from the wall for possible or planned cable entries.
- If applicable, remove transport protection from the built-in cells or monobloc batteries.
- Check cells or monobloc batteries for correct positioning and for any mechanical damage.

3.2
Cabinets with **separately delivered** cells or monobloc batteries:

- Only filled and charged cells and/or monobloc batteries (vented or valve regulated) are built into cabinets.
- Assemble cabinet, place and align at the assigned location (observe the accident prevention rules).
- Place cells or monobloc batteries in the cabinet, in accordance with the installation plan and the defined distances, connect electrically and apply markings (see point 2.4).

4. CE marking

From 1 January 1997, batteries with a nominal voltage from 75 V onwards require an EC conformity declaration in accordance with the low voltage directive (73/23/EWG), which entails that the CE marking is applied to the battery.
The company installing the battery is responsible for supplying the declaration and applying the CE marking.

WARNING:
Prior to connecting the battery to the charger, ensure that all installation work has been duly completed.

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Deutsche EXIDE GmbH
Im Thiergarten
63654 Büdingen – Germany

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

www.networkpower.exide.com

State: January 2004

EXIDE TECHNOLOGIES
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MARATHON™

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Marathon L
Operating Instruction 41410
Stationary, valve regulated lead acid batteries

Nominal data

- Nominal voltage U_N : 2.0 V x number of cells
- Nominal capacity $C_N = C_{10}$: 10h discharge (see type plate on cells/blocs and technical data in these instructions)
- Nominal discharge current $I_N=I_{10}$: C_N / 10h
- Final discharge voltage U_f : see technical data in these instructions
- Nominal temperature T_N : 20°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 be carried out by qualified personnel only.

- 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 50 272-2, DIN VDE 0510, VDE 0105 Part 1.

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

- Explosion and fire hazard, avoid short circuits.

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

- Cells/bloc batteries are heavy! Always use suitable handling equipment for transportation. Handle with care because bloc batteries 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, repairs made with other than original parts, or repairs made without authorization (e. g. opening of valves) render the warranty void.

Disposal of Batteries

Batteries marked with the recycling symbol should be processed via a recognised recycling agency. By agreement, they may be returned to the manufacturer. Batteries must not be mixed with domestic or industrial waste.

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

1. Start Up

Check all cells/blocs for mechanical damage, correct polarity and firmly seated connectors. The following torques apply for screw connectors:

M 6	M 8	M 12
6 Nm ± 1	8 Nm ± 1	25 Nm ± 1

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 should not be connected.
Switch on charger and start charging following instruction no. 2.2.

2. Operation

For the installation and operation of stationary batteries DIN VDE 0510 part 1 (draft) and 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 to 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 DIN VDE 0510 part 1, draft) 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 at 2.27 Vpc (Volt per cell) ± 1% x number of cells measured at the end terminals of the battery. To reduce the charging time a boost-charging stage can be applied in which the charging voltage of 2.33 to 2.40 Vpc ± 1% x number of cells can be adjusted (standby-parallel operation with boost recharging stage). Automatic change over to 2.27 Vpc ± 1% x number of cells should be applied.

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 at 2.27 to 2.30 Vpc ± 1% x number of cells. This has to be carried out in accordance with the manufacturers instructions.

c.) Switchmode-Operation

When charging, the battery is separated from the load. The charge-voltage of the battery is max. 2.35 Vpc ± 1%. The charging process must be monitored. If the charge-current reduces to less than 1.5A/100Ah with 2.35 Vpc ± 1%, the mode switches to float-charge acc. to item 2.3 (switches after reaching 2.35 Vpc ± 1%).

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 2.27 Vpc± 1%.

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 have to be carried out as follows: Up to 48 hours at max. 2.40 Vpc. The charge current must not exeed 20A/100Ah nominal capacity. The monobloc 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 5A(RMS)/100Ah 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 10A to 30A/100 Ah nominal capacity (guide values).

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

2.8 Temperature-related charge voltage
A temperature-related adjustement of the charge voltage within the operating temperature of 15° C to 25° C is not necessary.
If the operation temperature is constantly outside this range, the charge voltage has to be adjusted.
The temperature correction factor is:
-0.005 Vpc x K.

The following temperature related charge voltages must be used during float charge:

Battery temperature [°C]	Charge voltage [Vpc]
-10	2.42
0	2.37
10	2.32
20	2.27
30	2.22
40	2.21

The adjusted voltage shall never be less than 2.21 Vpc and shall never exceed 2.42 Vpc.

2.9 Electrolyte
The electrolyte is diluted sulphuric acid and fixed in a glas mat.

3. Battery maintenance and control
Keep the battery clean and dry to avoid creeping currents. 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
– Voltage of several cells and blocs
– Surface temperature of several cells/blocs
– Battery-room temperature
If the cell voltage differes from the average float charge voltage by more than +0.2 V resp. -0.1 V or if the surface temperature difference between monoblocs is exceeding 5 K, the service-agent should be contacted.

In addition, annual measurement and recording:
– Voltage of all cells and blocs
– Surface temperature of all cells/blocs
– Battery-room temperature
– Insulation-resistance acc. to DIN 43539 part 1

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 896-2, DIN 43539 part 1 and 100 (draft).
Special instructions like DIN VDE 0107 and DIN VDE 0108 have to be observed.

Capacity test
Capacity test (for instance, acceptance test on site): In order to make sure the battery is fully charged, the following IU-charge methods can be applied:
Option 1: 2.27 Vpc ≥ 48 hours.
Option 2: 2.40 Vpc ≥ 16 hours (max. 48 hours) followed by 2.27 Vpc ≥ 8 hours.
The current available to the battery must be between 10A/100Ah (max. 30A/100Ah) of the nominal capacity.

New batteries
New batteries should be subjected to an initial charge with a higher voltage, adjusted in function of temperature (see point 2.8.). Under no circum-stances shall 2.40 Vpc be exceeded in this operation. It is also possible to use the time when the voltage of the weakest unit increases as a criterion for determining the end of initial charge.

Temp./ [°C]	Charging voltage/ [Vpc]	Charging time/ [h]
20	2.30	96
20	2.35	48

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/blocs for a longer period of time they should be fullycharged and stored in a dry frost-free room.
To avoid damage the following charging-methods can be chosen:
1. Annual equalizing-charge acc. to 2.4. in average ambient temperatures of more than 20° C shorter intervals may be necessary.
2. Float charging as detailed in 2.3.

7. Transport
Cells/bloc batteries 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/bloc batteries 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 may be found on the exteriors of the packing unit.
Cells/bloc batteries whose containers leak or are damaged must be packed and transported as class 8 dangerous goods under UN no. 2794.

8. Technical data, Marathon L

discharge time	10 min	30 min	1 h	3 h	5 h	10 h
capacity	$C_{1/6}$	$C_{1/2}$	C_1	C_3	C_5	C_N/C_{10}
L12V15	6.5 Ah	8.1 Ah	9.5 Ah	12.3 Ah	12.5 Ah	14.0 Ah
L12V24	10.7 Ah	13.3 Ah	15.1 Ah	20.4 Ah	21.0 Ah	23.0 Ah
L12V32	14.1 Ah	17.7 Ah	20.5 Ah	27.3 Ah	29.5 Ah	31.5 Ah
L12V42	19.6 Ah	25.0 Ah	28.5 Ah	37.2 Ah	38.5 Ah	42.0 Ah
L12V55	21.6 Ah	28.2 Ah	34.5 Ah	42.9 Ah	48.0 Ah	55.0 Ah
L12V80	30.3 Ah	40.0 Ah	48.8 Ah	61.5 Ah	69.0 Ah	80.0 Ah
L6V110	48.5 Ah	62.0 Ah	73.5 Ah	98.4 Ah	104.0 Ah	112.0 Ah
L6V160	66.6 Ah	89.5 Ah	105.0 Ah	126.3 Ah	142.0 Ah	162.0 Ah
L2V220	87.1 Ah	120.5 Ah	141.0 Ah	178.2 Ah	194.0 Ah	220.0 Ah
L2V270	104.1 Ah	148.5 Ah	162.0 Ah	218.4 Ah	238.0 Ah	270.0 Ah
L2V320	130.7 Ah	180.5 Ah	214.0 Ah	261.0 Ah	283.5 Ah	320.0 Ah
L2V375	152.4 Ah	212.0 Ah	250.0 Ah	306.0 Ah	332.5 Ah	375.0 Ah
L2V425	160.9 Ah	234.0 Ah	274.0 Ah	345.0 Ah	375.0 Ah	425.0 Ah
L2V470	186.6 Ah	264.0 Ah	305.0 Ah	382.2 Ah	419.5 Ah	470.0 Ah
L2V520	204.1 Ah	290.0 Ah	337.0 Ah	423.0 Ah	466.5 Ah	520.0 Ah
L2V575	220.8 Ah	317.5 Ah	372.0 Ah	468.0 Ah	516.0 Ah	575.0 Ah
U_f (2 V cell)	1.60 V	1.70 V	1.74 V	1.78 V	1.79 V	1.80 V
U_f (6 V bloc)	4.80 V	5.10 V	5.22 V	5.34 V	5.37 V	5.40 V
U_f (12 V bloc)	9.60 V	10.20 V	10.44 V	10.68 V	10.74 V	10.80 V

All technical data refer to 20°C.

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Deutsche EXIDE GmbH
Im Thiergarten
63654 Büdingen – Germany

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

www.networkpower.exide.com

State: February 2004

EXIDE TECHNOLOGIES
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35 0 42510 10

Sprinter P
Operating Instruction 42510
Stationary, valve regulated lead acid batteries

Nominal data

- Nominal voltage U_N : 2.0 V x number of cells
- Nominal capacity $C_N = C_{10}$: 10h discharge (see type plate on monoblocs and technical data in these instructions)
- Nominal discharge current $I_N=I_{10}$: C_N / 10h
- Final discharge voltage U_f : see technical data in these instructions
- Nominal temperature T_N : 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 be carried out by qualified personnel only.

- 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 50 272-2, DIN VDE 0510, VDE 0105 Part 1!

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

- Explosion and fire hazard, avoid short circuits!

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

- Monoblocs are heavy! Always use suitable handling equipment for transportation! Handle with care because monoblocs are sensitive to mechanical shock!

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

Non-compliance with operating instructions, repairs made with other than original parts, or repairs made without authorization (e. g. opening of valves) render the warranty void.

Disposal of Batteries

Batteries marked with the recycling symbol should be processed via a recognised recycling agency. By agreement, they may be returned to the manufacturer. Batteries must not be mixed with domestic or industrial waste.

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

1. Start Up

Check all blocs for mechanical damage, correct polarity and firmly seated connectors. The following torques apply for screw connectors:

M 6	M 8
6 Nm ±1	8 Nm ±1

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 should not be connected.
Switch on charger and start charging following instruction no. 2.2.

2. Operation

For the installation and operation of stationary batteries DIN VDE 0510 part 1 (draft) and 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 to 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 DIN VDE 0510 part 1, draft) may be carried out in following operations.

a.) Standby Parallel Operation

Here the load, battery and battery charger are continously 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 at 2.27 Vpc (Volt per cell) ± 1% x number of cells measured at the end terminals of the battery. To reduce the charging time a boost-charging stage can be applied in which the charging voltage of up to 2.40 Vpc ± 1% x number of cells can be adjusted (standby-parallel operation with boost recharging stage). Automatic change over to 2.27 Vpc ± 1% x number of cells should be applied.

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 at 2.27 to 2.30 Vpc ± 1% x number of cells. This has to be carried out in accordance with the manufacturers instructions.

c.) Switchmode-Operation

When charging, the battery is separated from the load. The charge-voltage of the battery is max. 2.35 Vpc ± 1%. The charging process must be monitored. If the charge-current reduces to less than 1.5A/100Ah with 2.35 Vpc ± 1%, the mode switches to float-charge acc. to item 2.3 (switches after reaching 2.35 Vpc ± 1%).

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 2.27 Vpc± 1%.

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 have to be carried out as follows: Up to 48 hours at max. 2.40 Vpc. The charge current must not exeed 20 A/ 100Ah nominal capacity. The monobloc 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 2.30 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 10 A to 30 A / 100 Ah nominal capacity (guide. values).

2.7 Temperature
The recommended operation temperature range for lead acid batteries is 20° C ± 5 K. Higher temperatures will seriously reduce service life.
All technical data is produced for a nominal temperatur of 25° C.
Lower temperatures reduce the available capacity. The absolute maximum temperature is 55° C and should not exceed 45° C in service.

2.8 Temperature-related charge voltage
A temperature-related adjustement of the charge voltage within the operating temperature of 15° C to 25° C is not necessary.
If the operation temperature is constantly outside this range, the charge voltage has to be adjusted.
The temperature correction factor is:
-0.005 Vpc x K.

The following temperature related charge voltages must be used during float charge:

Battery temperature [°C]	Charge voltage [Vpc]
-10	2.40
0	2.35
10	2.32
20	2.29
25	2.27
30	2.25
40	2.22

The adjusted voltage shall never be less than 2.22 Vpc and shall never exceed 2.40 Vpc.

2.9 Electrolyte
The electrolyte is diluted sulphuric acid and fixed in a glas mat.

3. Battery maintenance and control
Keep the battery clean and dry to avoid creeping currents. 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
- Voltage of several monoblocs
- Surface temperature of several monoblocs
- Battery-room temperature

If the cell voltage differes from the average float charge voltage by more than + 0.2 V respectively -0.1V or if the surface temperature difference between monoblocs is exceeding 5 K, the service-agent should be contacted.

In addition, annual measurement and recording:
- Voltage of all monoblocs
- Surface temperature of all monoblocs
- Battery-room temperature
- Insulation-resistance acc. to DIN 43539 part 1

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 896-2, DIN 43539 part 1 and 100 (draft).
Special instructions like DIN VDE 0107 and DIN VDE 0108 have to be observed.

Capacity test
Capacity test (for instance, acceptance test on site): In order to make sure the battery is fully charged, the following IU-charge methods can be applied:
Option 1: 2.27 Vpc ≥ 48 hours.
Option 2: 2.40 Vpc ≥ 16 hours (max. 48 hours) followed by 2.27 Vpc ≥ 8 hours.

The current available to the battery must be between 10A /100Ah (max. 30 A/ 100Ah) of the nominal capacity.

New batteries
New batteries should be subjected to an initial charge with a higher voltage, adjusted in function of temperature (see point 2.8.). Under no circum-stances shall 2.40 Vpc be exceeded in this operation. It is also possible to use the time when the voltage of the weakest unit increases as a criterion for determining the end of initial charge.

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 bloc batteries for a longer period of time they should be fullycharged and stored in a dry frost-free room.
To avoid damage the following charging methods can be chosen:
1. Annual equalizing-charge acc. to 2.4. in average ambient temperatures of more than 20° C shorter intervals may be necessary.
2. Float charging as detailed in 2.3.

7. Transport
Bloc batteries must be transported in an upright position. Bloc 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. Monoblocs 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 may be found on the exteriors of the packing unit.
Bloc batteries whose containers leak or are damaged must be packed and transported as class 8 dangerous goods under UN no. 2794.

8. Technical data Sprinter P

The battery is espacially 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 are produced for a nominal temperature of 25° C.

Type	Voltage [V]	Power 15' 1.60 V/cell @ 25° C [W]	Capacity 10h 1,80V/cell @ 25° C [Ah]
P12V570	12	570	21
P12V600	12	600	24
P12V875	12	875	41
P12V1220	12	1220	51
P12V1575	12	1575	61
P12V2130	12	2130	86
P 6V1700	6	1700	122
P 6V2030	6	2030	178

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Deutsche EXIDE GmbH
Im Thiergarten
63654 Büdingen - Germany

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

www.networkpower.exide.com

State: June 2003

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COOPER

CEAG Notlichtsysteme GmbH

Senator-Schwartz-Ring 26
D-59494 Soest / Germany
Telefon +49 (0) 29 21/69-8 70
Telefax +49 (0) 29 21/69-6 17
Internet www.ceag.de
E-Mail info-n@ceag.de