81700849

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.
- Avoid electrostatic charges and discharges/sparks!

- 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 (2006/66/EC) 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 XL	--	--	11 Nm	--	--	--
Marathon M/M-FT	6 Nm	--	11 Nm	6 Nm	--	--
Sprinter P/XP	--	--	11 Nm	6 Nm	8 Nm	--
Sprinter S	--	--	11 Nm	--	--	--
Powerfit S300	--	5 Nm	--	--	8 Nm	--
Powerfit S500	--	--	--	6 Nm	8 Nm	--

Gel-Type	G-M5	F-M5	F-M6	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	11 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 XL	2.27	25
Marathon M	2.27	25
Sprinter P/XP	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 XL	2.35-2.40	25
Marathon M	2.35-2.40	25
Sprinter P/XP	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 XL	2.30	25
Marathon M	2.29-2.33	25
Sprinter P/XP	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 XL	10 to 30 A per 100Ah
Marathon M	10 to 35 A per 100Ah
Sprinter P/XP	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

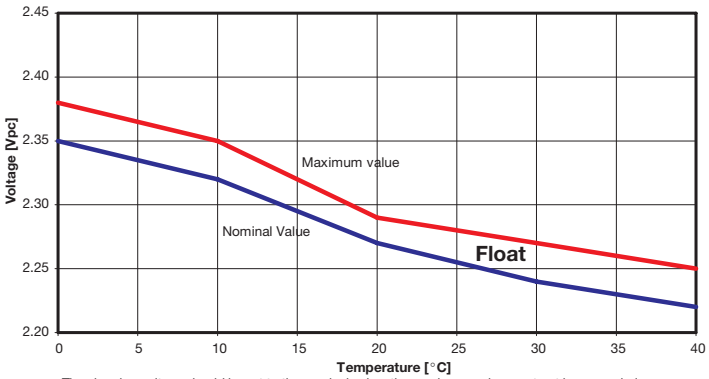
Table 5: Charging currents

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

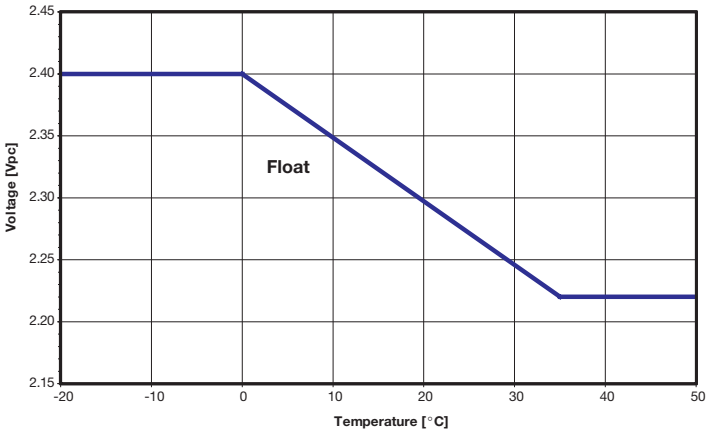


Fig. 2: Marathon XL, Marathon M, Sprinter P/XP, Sprinter S; charging voltage vs. temperature

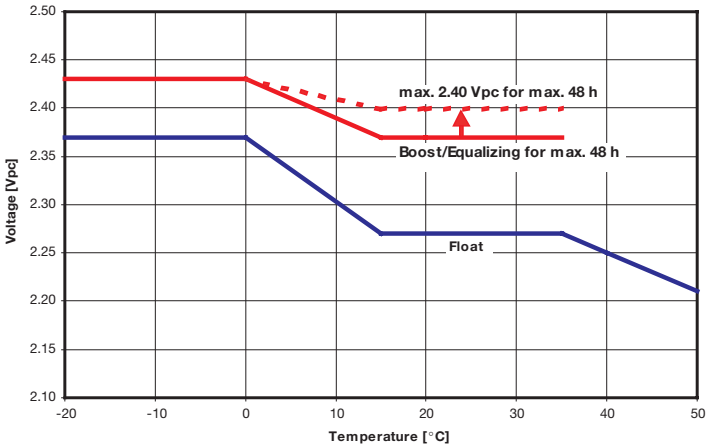


Fig. 3: A 400; charging voltage vs. temperature

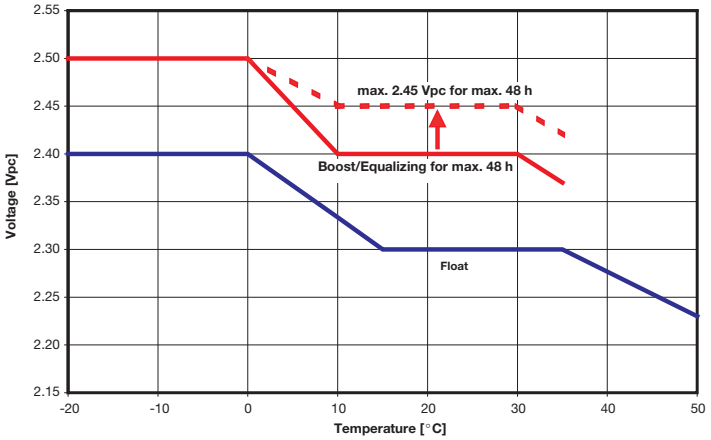


Fig. 4: A 500; charging voltage vs. temperature

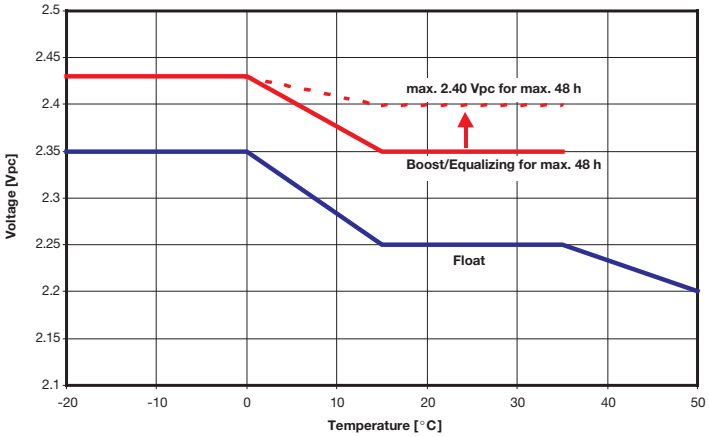


Fig. 5: A 600, A 700; charging voltage vs. temperature

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 XL	--	--	+0.35/-0.17	--	+0.49/-0.24
Marathon M	--	--	+0.35/-0.17	--	+0.49/-0.24
Sprinter P/XP	--	--	+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 XL	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/XP	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.

Battery block type	Nominal voltage [V]	C10 [Ah], 1.80 Vpc, 20° C	Constant k
M12V45F	12	45	**1842**
M12V35 FT	12	35	**2228**
M12V50 FT	12	47	**1659**
M12V60 FT	12	59	**1322**
M12V90 FT	12	85	**1324**
M12V105 FT	12	100	**1107**
M12V125 FT	12	121	**930**
M12V155 FT	12	150	**750**
M6V200	6	200	**873**
S12V500	12	130	**648**
A 412/85 F10	12	85	**786**
A 412/48 FT	12	48	**1624**
A 412/120 FT	12	110	**810**

Table 9: Constant k for different block battery types having central degassing

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/XL

Discharge time t_n	10 min	30 min	1 h	3 h	5 h	10 h	Length max. [mm]	Width max. [mm]	Height max. [mm]	Weight approx. [kg]
Capacity C_n [Ah]	$C^1/_6$	$C^1/_2$	C_1	C_3	C_5	C_{10}				
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	209	136	265	16.0
L2V270	106.3	155.5	183.0	229.2	243.0	270.0	209	136	265	18.3
L2V320	135.8	190.5	225.0	271.8	288.0	320.0	209	202	265	24.2
L2V375	155.8	221.5	262.0	318.0	337.5	375.0	209	202	265	26.5
L2V425	169.9	247.0	291.0	360.0	382.5	425.0	209	202	265	28.8
L2V470	186.6	277.0	324.0	399.0	428.5	470.0	209	270	265	32.6
L2V520	204.1	304.5	357.0	438.0	474.0	520.0	209	270	265	35.0
L2V575	220.8	334.5	394.0	486.0	520.0	575.0	209	270	265	37.3
XL12V70	28.6	39.1	45.6	57.0	61.5	66.6	262	172	239	25.0
XL12V85	34.6	48.1	57.5	73.5	80.5	85.7	309	172	239	29.7
XL6V180	74.3	100	120	147	165.5	179	309	172	241	30.5
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	10.2	10.5	10.8				

All technical data refer to 20° C.

9.1.2. Marathon M

Type	Nominal voltage [V]	C_8 [Ah] 1.75 V per cell	Constant current discharge [A]. U_f = 1.75 V per cell						Length max. [mm]	Width max. [mm]	Height max. [mm]	Weight approx. [kg]
			0.5 h	1 h	1.5 h	3 h	5 h	10 h				
M12V30T	12	30	36.9	21.2	15.1	8.40	5.50	2.90	171	130	186	10.7
M12V40(F)	12	40	51.3	30.5	21.5	11.9	7.60	4.10	198	167	189	17.8
M12V45F	12	45	57.8	33.2	24.0	13.5	8.70	4.70	220	121	254	17.5
M12V70(F)	12	70	90.8	51.6	36.8	20.6	13.4	7.40	260	174	235	27.8
M12V90(F)	12	90	107	65.7	46.6	25.9	16.7	9.20	306	174	235	32.8
M6V190(F)	6	190	246	144	102	56.0	35.9	19.5	306	174	235	33.5
M6V200FT	6	200	220	135	100	55.2	36.3	20.2	361	132	250	34.0
M12V35FT	12	35	44.0	26.5	14.0	10.2	6.60	3.50	280	107	189	14.0
M12V50FT	12	47	61.0	34.3	20.0	13.5	8.80	4.70	280	107	231	18.0
M12V60FT	12	59	68.8	40.1	26.0	16.6	11.0	6.00	280	107	263	23.0
M12V90FT	12	86	108	64.0	46.4	24.9	15.9	8.70	395	105	270	31.0
M12V105FT	12	100	115	70.0	51.6	28.5	18.7	10.3	511	110	238	35.8
M12V125FT	12	121	141	88.1	65.3	37.2	23.4	12.4	559	124	283	47.6
M12V155FT	12	150	174	103	77.7	43.2	28.1	15.4	559	124	283	53.8

All technical data refer to 25° C.

9.1.3. 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 max. [mm]	Width max. [mm]	Height [1] max. [mm]	Weight approx. [kg]
P12V600	12	600	24	169	128	175	9.50
P12V875	12	875	41	200	169	176	14.5
P12V1220	12	1220	51	233	169	191	19.5
P12V1575	12	1575	61	273	167	191	24.0
P12V2130	12	2130	86	360	173	227	33.0
P 6V1700	6	1700	122	273	167	191	25.0
P 6V2030	6	2030	178	360	172	227	32.5
XP 12V1800	12	1370	56.4	220	172	235	22.5
XP 12V2500	12	1870	69.5	262	172	239	27.7
XP 12V3000	12	2350	92.8	309	172	239	32.8
XP 6V2800	6	2270	195	309	172	241	32.6

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 25° C.

[1] Includes installed connector

9.1.4. Sprinter S

Type	Nominal voltage [V]	C_8 [Ah] U_f = 1.80 V per cell	Constant power [Watt per cell]. U_f = 1.67 V per cell						Length max. [mm]	Width max. [mm]	Height max. [mm]	Weight approx. [kg]
			5 min	10 min	15 min	30 min	60 min	90 min				
S12V120(F)	12	24	242	151	117	72	41	29	173	167	161	12.1
S12V170(F)	12	40	323	215	167	102	58	41	198	167	189	16.4
S12V285(F)	12	70	543	365	285	169	96	69	260	174	235	27.8
S12V300(F)	12	69	654	415	306	180	105	76	260	174	235	28.7
S12V370(F)	12	87	723	484	373	230	131	92	306	174	235	33.4
S12V500(F)	12	131	864	615	505	310	176	126	344	172	288	48.1
S6V740(F)	6	175	1446	970	746	458	262	184	306	174	235	33.4

All technical data refer to 25° C.

9.1.5. Powerfit S 300

Type	Nominal voltage [V]	C_{20} [Ah] 1.75 V per cell	C_{10} [Ah] 1.75 V per cell	C_1 [Ah] 1.60 V per cell	Length* [mm]	Width* [mm]	Height** [mm]	Weight approx. [kg]
S306/1.2 S	6	1.2	1.13	0.78	97	25	56	0.30
S306/4 S	6	4.0	3.80	2.62	70	47	106	0.85
S306/7 S	6	7.0	6.55	4.58	151	34	100	1.30
S306/12 S	6	12	11.4	7.86	151	50	100	2.05
S312/1.2S	12	1.2	1.13	0.78	97	45	59	0.59
S312/2.3 S	12	2.3	2.19	1.50	178	34	65	0.94
S312/3.2 S	12	3.2	3.00	1.96	134	67	66	1.30
S312/4 S	12	4.0	3.80	2.62	90	70	106	1.67
S312/7 S	12	7.0	6.64	4.58	151	65	98	2.60
S312/12 S	12	12	11.4	7.86	151	98	98	4.03
S312/18 G5	12	18	16.1	11.1	181	76	166	6.15
S312/26 G5	12	26	24.7	17.0	166	175	125	9.40
S312/40 G5	12	40	37.9	26.2	196	165	171	14.3

All technical data refer to 20° C.
Figures are also valid for other teminals.

* ± 2mm
** ± 3mm

9.1.6. Powerfit S 500

Type	Nominal voltage [V]	C_{20} [Ah] 1.75 V per cell	C_{10} [Ah] 1.75 V per cell	C_1 [Ah] 1.60 V per cell	Length max. [mm]	Width max. [mm]	Height max. [mm]	Weight approx. [kg]
S512/25	12	25.0	24.0	15.8	168	127	174	9.50
S512/38	12	38.0	36.0	23.2	198	168	175	13.5
S512/50	12	51.0	48.0	32.5	234	169	190	18.5
S512/60	12	61.0	58.0	40.8	272	166	190	23.0
S512/92	12	92.0	87.0	54.4	359	172	226	30.0
S506/130	6	128	121	80.0	272	166	190	23.0
S506/185	6	185	174	116	359	171	226	31.5

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 max.	Width max.	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	28.5
A412/5,5	1.83	2.80	3.40	4.80	5.00	5.00	152	65.5	98.4	2.50
A412/8,5	2.67	3.90	4.70	6.60	7.50	8.00	152	98.0	98.4	3.60
A412/12	3.83	5.50	6.80	8.70	10.0	12.0	181	76.0	157	5.60
A412/20	7.00	9.50	12.0	15.0	16.5	20.0	167	176	126	9.00
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	196	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	37.0
A412/120	38.0	56.0	71.0	87.9	98.0	120	513	223	223	46.0
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	40.0
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 max.	Width max.	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	52.9	50.5	98.4	0.70
A504/3.5	1.40	1.95	2.30	3.00	3.15	3.3	3.50	90.5	34.5	64.4	0.50
A506/1.2	0.50	0.66	0.80	1.05	1.1	1.00	1.20	97.3	25.5	55.6	0.33
A506/3.5	1.40	1.95	2.30	3.00	3.15	3.3	3.50	135	34.8	64.4	0.70
A506/4.2	1.10	1.75	2.50	3.78	3.95	4.00	4.20	52.0	62.3	102	0.90
A506/6.5	2.60	3.50	4.00	4.80	5.50	6.3	6.50	152	34.5	98.4	1.30
A506/10	4.80	6.40	7.10	9.00	9.50	10.0	10.0	152	50.5	98.4	2.10
A508/3.5	1.40	1.95	2.30	3.00	3.15	3.3	3.50	179	34.1	64.4	1.0
A512/1.2	0.50	0.66	0.80	1.05	1.1	1.00	1.20	97.5	49.5	54.9	0.65
A512/2	0.80	1.10	1.50	1.80	1.85	1.9	2.00	179	34.1	64.4	1.00
A512/3.5	1.40	1.95	2.30	3.00	3.15	3.3	3.50	135	66.8	64.4	1.50
A512/6.5	2.60	3.50	4.00	4.80	5.50	6.3	6.50	152	65.5	98.4	2.60
A512/10	4.80	6.40	7.10	9.00	9.50	10.0	10.0	152	98.0	98.4	4.00
A512/16	7.00	9.00	10.6	13.8	14.5	15.0	16.0	181	76	167	6.00
A512/25	7.80	11.45	14.4	18.6	20.5	22.0	25.0	167	176	126	9.60
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	105.3	113	119	140	513	223	223	47.0
A512/200	68.5	101	120	151.8	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.

9.2.3. A 600

Type	DIN type designation	Nominal voltage [V]	C_1 [Ah]	C_3 [Ah]	C_5 [Ah]	C_{10} [Ah]	Length max. [mm]	Width max. [mm]	Height [1] max. [mm]	Weight approx. [kg]
A612/100	12 V 2 OPzV 100	12	58.9	76.5	82.5	91.0	273	204	358	43.0
A612/150	12 V 3 OPzV 150	12	86.9	114	124	137	381	204	358	63.0
A606/200	6 V 4 OPzV 200	6	114	152	165	182	273	204	358	43.0
A606/300	6 V 6 OPzV 300	6	168	229	248	274	381	204	358	62.0
A602/200	4 OPzV 200	2	123	183	201	224	105	208	399	19.0
A602/250	5 OPzV 250	2	154	229	251	280	126	208	399	23.0
A602/300	6 OPzV 300	2	185	275	302	337	147	208	399	27.0
A602/350	5 OPzV 350	2	239	349	406	416	126	208	515	30.0
A602/420	6 OPzV 420	2	287	419	487	499	147	208	515	35.0
A602/490	7 OPzV 490	2	335	489	568	582	168	208	515	39.0
A602/600	6 OPzV 600	2	437	586	676	748	147	208	690	49.0
A602/800	8 OPzV 800	2	583	783	899	998	212	193	690	66.0
A602/1000	10 OPzV 1000	2	729	979	1123	1248	212	235	690	80.0
A602/1200	12 OPzV 1200	2	874	1176	1347	1497	212	277	690	95.0
A602/1500	12 OPzV 1500	2	958	1335	1445	1643	212	277	840	117
A602/2000	16 OPzV 2000	2	1278	1780	1927	2190	216	400	816	160
A602/2500	20 OPzV 2500	2	1598	2225	2409	2738	214	489	816	198
A602/3000	24 OPzV 3000	2	1917	2670	2891	3286	214	578	816	238
	U_f [V] (2 V cell)	--	1.60	1.70	1.75	1.80				
	U_f [V] (6 V block)	--	4.95	5.10	5.25	5.40				
	U_f [V] (12 V block)	--	9.90	10.20	10.50	10.80				

All technical data refer to 20° C.

[1] Includes installed connector

9.2.4. A 700

Discharge time t_n	10 min	30 min	1 h	3 h	5 h	10 h	Length max. [mm]	Width max. [mm]	Height max. [mm]	Weight approx. [kg]
Capacity C_n [Ah]	$C^1/_6$	$C^1/_2$	C_1	C_3	C_5	C_{10}				
A706/21	7.00	10.2	12.2	16.5	19.0	21.0	115	178	268	8.50
A706/42	14.1	20.5	24.4	33.0	38.0	42.0	115	178	268	10.1
A706/63	21.1	31.7	36.6	49.5	57.0	63.0	198	178	272	16.3
A706/84	28.3	41.0	48.8	66.0	76.5	84.0	198	178	272	18.3
A706/105	35.3	51.0	61.0	82.8	95.5	105.0	282	178	272	25.3
A706/126	42.5	61.5	73.2	99.3	114.5	126.0	282	178	272	26.2
A706/140	42.1	69.5	85.3	117.0	131.0	140.0	285	232	327	36.3
A706/175	52.8	86.5	106.0	146.4	163.5	175.0	285	232	327	39.7
A706/210	63.3	104.0	128.0	175.5	196.0	210.0	285	232	327	42.9
A704/245	74.0	121.5	149.0	204.9	229.0	245.0	250	232	327	35.5
A704/280	84.5	139.0	170.0	234.0	261.5	280.0	250	232	327	39.0
U_f [V] (4 V block)	3.2	3.2	3.3	3.4	3.4	3.6				
U_f [V] (6 V block)	4.8	4.8	4.95	5.1	5.1	5.4				

All technical data refer to 20° C.

NXEVROEPDF00510 · Druckhaus Bechstein · Printed in Germany · Subject to change
81700849 5,0 V.10

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