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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 electrolyte 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-male	M 8-female	M 12
6 Nm ±1	8 Nm ±1	20 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 exceed 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 temperature 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 adjustment 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 differs 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 func-

tion of temperature (see point 2.8.). Under no circumstances 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 fully charged 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 ₁₀ /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 _r (2 V cell)	1.60 V	1.70 V	1.74 V	1.78 V	1.79 V	1.80 V
U _r (6 V bloc)	4.80 V	5.10 V	5.22 V	5.34 V	5.37 V	5.40 V
U _r (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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