

Operating Instruction 41410 for stationary, valve regulated lead acid batteries

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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 or monoblocs and technical data in these instructions)
- Nominal discharge current $I_N = I_{10}$: $C_N / 10$ h
- Final discharge voltage U_f : see technical data in these instructions
- Nominal temperature T_N : 20° C

Assembly by: _____ EXIDE Technologies order no.: _____ date: _____
 Commissioned by: _____ date: _____
 Safety signs attached by: _____ date: _____

	<ul style="list-style-type: none"> Observe these instructions and keep them located nearby the battery for future reference. Work on the battery should only be carried out by qualified personnel.
	<ul style="list-style-type: none"> Do not smoke. Do not use any naked flame or other sources of ignition. Risc of explosion and fire.
	<ul style="list-style-type: none"> While working on batteries wear protective eye-glasses and clothing. Observe the accident prevention rules as well as EN 50272-2, DIN VDE 0510, VDE 0105 Part 1.
	<ul style="list-style-type: none"> Any acid splashes 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.
	<ul style="list-style-type: none"> Explosion and fire hazard, avoid shortcircuits. Caution! Metal parts of the battery are always alive, therefore do not place items or tools on the battery.
	<ul style="list-style-type: none"> Electrolyte is very corrosive. In normal working conditions the contact with the electrolyte is impossible. If the cell or monobloc container is damaged do not touch the exposed electrolyte because it is corrosive.
	<ul style="list-style-type: none"> Cells and monoblocs are heavy. Always use suitable handling equipment for transportation. Handle with care because cells and monoblocs are sensitive to mechanical shock.

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.

	<p>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.</p>
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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 and monoblocs for mechanical damage, correct polarity and firmly seated connectors. The following torque values 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 shall 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 item 2.2.

2. Operation

For the installation and operation of stationary batteries DIN VDE 0510, part 1 (draft) and EN 50272-2 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 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). Depending to the charging equipment, specification and characteristics alternating currents flow through the battery superimposing onto the direct

current during charging operation. 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 2.27Vpc (Volt per cell) ± 1% x number of cells measured at the end terminals of the battery. To reduce the charging time, a boost-charging state can be applied in which the charging voltage of 2.33 – 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 2.27Vpc ± 1% 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 1.5 A/100 Ah 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. 2.4 Vpc. The charge current must not exceed 20A/100Ah nominal capacity. The cell or 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 2.4 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 20 A/100Ah 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. 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 operating temperature is constantly outside this range, the charge voltage has to be adjusted. The temperature correction factor is $-0.005 \text{ Vpc} \times \text{K}$. The following temperature related charge voltages must be used during float charge:

battery temperature	voltage
-10° C	2.42 Vpc
0° C	2.37 Vpc
10° C	2.32 Vpc
20° C	2.27 Vpc
30° C	2.22 Vpc
40° C	2.17 Vpc

2.9 Electrolyte

The electrolyte is diluted sulphuric acid and fixed in a micro-porous glass mat.

3. Battery maintenance and control

Keep the battery clean and dry to avoid creeping current. 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 or monoblocs
 - Surface temperature of several cells or monoblocs
 - Battery-room temperature
- If the cell voltages differs from the average float charge voltage by more than + 0.2V respectively - 0.1V or if the surface temperature difference between cells or monoblocs is exceeding 5 K, the service-agent should be contacted.

In addition, annual measurement and recording:

- Voltage of all cells or monoblocs
- Surface temperature of all cells or monoblocs
- Battery-room temperature
- Insulation-resistance according 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: 2.35 Vpc, ≥ 16 hours (max. 48 hours) followed by 2.27 Vpc, ≥ 8 hours. The current available to the battery must be between 10 A/100 Ah (max. 20A/100Ah) of the nominal capacity.

5. Faults

Call the service agent 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 your agent.

6. Storage and taking out of operation

To store or decommission cells or monoblocs for a longer period of time they should be fully charged and stored in a dry and frost-free room, away from direct sunlight. 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

All cells and monoblocs are to be transported in an upright position. To avoid short circuits the terminals have to be fully insulated. Batteries without any visible damages are not defined as dangerous goods if they are protected against short circuit, slipping, upsetting or damaging and packed in upright, proper and secure condition onto pallets. In case of damaged battery containers refer to national regulations (dangerous goods).

8. Technical data

8.1 Capacities (C_n) at different discharge times (t_n) until the final discharge voltage (U_s) All technical data refer to 20° C.

discharge time t _n	10 min	30 min	1 h	3 h	5 h	10 h
capacity/plate t _n	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
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 _s (2 V cell)	1.60 V	1.70 V	1.74 V	1.78 V	1.79 V	1.80 V
U _s (6 V bloc)	4.80 V	5.10 V	5.22 V	5.34 V	5.37 V	5.40 V
U _s (12 V bloc)	9.60 V	10.20 V	10.44 V	10.68 V	10.74 V	10.80 V



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