

1. Storage and transport

- Store batteries in a dry, light-protected and cool environment (frost-free).
- At the latest, recharge starter batteries in the case of off-load voltage > 12.5 V (see Note 3).
- Duracell declares all its starter batteries as wet and filled with acid in accordance with UN 2794.
- Wet-filled batteries must be transported in an upright position, as otherwise acid may escape.
- During transportation secure the battery to prevent it falling over or sliding around.
- First in, first out (FIFO) receipt.

2. Installation and removal from the vehicle.

Only install batteries with an off-load voltage of > 12.5 V.

- Follow the vehicle instructions.
- Switch off the engine and all power consumers prior to installing or removing the battery.
- Avoid short circuits due to tools.
- When removing the battery, first disconnect the negative (-) terminal and then the positive (+) terminal.
- Interruptions to the power supply may result in data loss. The Duracell Memory Saver can help.
- Prior to installing the battery, clean the battery compartment.
- Ensure that the battery is secured tightly.
- Clean terminals and battery clips and lubricate slightly with acid-free grease.
- When fitting the battery first connect the positive (+) terminal and then the negative (-) terminal. Ensure that the clips are secured.

3. Battery recharging

- Before charging flooded batteries, check the electrolyte level and top up if necessary with de-ionised or distilled water to the acid level mark or 15 mm above the upper edge of the plates at a maximum.

Duracell recommends that standard flooded batteries be charged outside the vehicle with 16 V for 24 hours.

Warning! Many chargers have a type of resuscitation mode for deep discharged Ca/Ca batteries. However, these only maintain a charging voltage of 16 V for a short period.

Duracell Extreme AGM. Always recharge with a voltage-controlled charger (max. 14.8 V). The use of a standard charger without voltage control destroys the battery due to overloading and cause the electrolyte to escape.

Warning! Follow the vehicle manufacturer's instructions when disconnecting the terminals.

- Batteries may only be charged with direct current. Connect the positive (+) battery terminal to the positive (+) terminal of the charger, and the negative (-) battery terminal to the negative (-) terminal of the charger.
- Do not switch on the charger until the battery has been connected. First switch off the charger when charging is completed.
- It is recommended that the charging current be equal to at least one tenth of the capacity (e.g. 44 Ah: 10 = 4.4 A charging current).
- The temperature of the acid may not be higher than 55°C during charging. If the temperature exceeds this level, the charging process must be discontinued.
- Charging is finished when the current drops to 0 or stops falling, or if the automatic charger switches off.
- Charging must be performed in a well-ventilated room.
- The battery screws may not be opened.
- Ensure that recharging amounts to 1.2 times the consumed capacity (e.g. Consumed capacity 30 Ah, recharge 36 Ah).

Warning! Oxyhydrogen gas is formed during charging! Fires, sparks, open flames and smoking are strictly prohibited!

Recharging batteries in the vehicle.

As a rule, fully automatic chargers (max. charging voltage 14.8 V) are well suited to the charging of batteries installed in the vehicle. Should the charger have an automatic mode with > 15.9 V voltages, the battery must be separated from the vehicle electrical system or removed from the vehicle. Otherwise, in a worst-case scenario the installed control devices can be destroyed due to overvoltage with huge resultant damage.

Please take careful note of the battery charger type. Useful tips regarding charging in the vehicle are often contained in the operating instructions of the vehicle manufacturer or those of the charger producer.

4. Maintenance

In order to ensure long battery life, the following instructions should be followed:

- Keep the surfaces of the battery clean and dry.
- Check the acid levels regularly and if necessary top up with deionised or distilled water. Never top up with acid. If a substantial water loss occurs, an expert should check the voltage regulator.
- Do not put so-called additives into the battery acid.
- **Warning!** Should the off-load voltage fall to < 12.5 V, recharge immediately in order to prevent lasting battery damage.

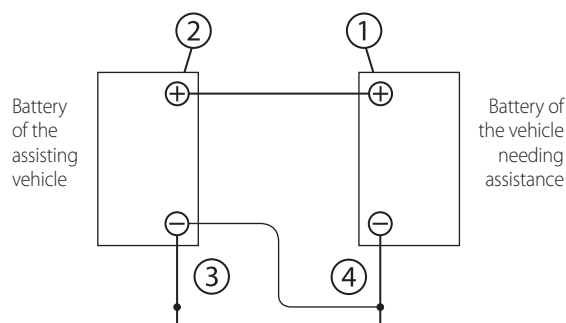
Duracell Extreme AGM. AGM batteries may not be opened. Acid density measurement and topping up with distilled water are neither possible nor necessary.

Duracell tip. Quarterly recharging of the battery greatly prolongs its life.

5. Assisted starting

- In view of the sensitive electronic components in the vehicle, as a rule starting assistance should only be provided by means of a Duracell Booster.
- Starting assistance from vehicle to vehicle can lead to voltage peaks during disconnection, which can damage or even destroy vehicle electronic systems.
- Therefore, it is essential that the following procedure be strictly observed when using starter cables!
- Standardised starter cables (e.g. in accordance with DIN 72 553) should always be used for giving starting assistance.
- Observe the instructions for use of the starter cables.
- Only connect batteries with the same nominal voltage.
- **When connecting the terminals, switch off both vehicle engines!**

First connect the two positive terminals (1) with (2). Then connect the negative terminal of the assisting vehicle (3) with (4), the blank metallic point on the vehicle needing assistance, away from the battery. (Observe the instructions of the vehicle manufacturer.)



- Now start the vehicle needing assistance for a maximum of 15 seconds. Do not start the assisting vehicle.
- When disconnecting the terminals, remove the cables in the reverse sequence to the above.

6. Decommissioning

- Charge the battery (see Note 3) and store in a cool dry place.
- Should the battery be left in the vehicle, disconnect the negative terminal.
- Regularly check the off-load voltage (see Note 4).

7. Influence of high temperatures

If batteries are subjected to high temperatures for long periods, this promotes both increased water consumption and grid corrosion. A corroded grid is no longer able to conduct current and therefore the battery fails. Resultant grid growth can also result in battery short circuits.

Warnings and Safety Rules for Lead-Acid Batteries



Take note of the information on the battery, the instructions for use and the operating instructions of the vehicle.



Wear eye protection.



Keep children away from acid and batteries.



Explosion danger:

- A highly explosive oxyhydrogen gas is emitted during battery charging therefore:



No naked flames, sparks, naked lights or smoking:

- Avoid sparking when handling cables and electronic devices.
- Avoid short circuits.



Chemical burns danger:

- Acid is highly caustic therefore:
- Wear gloves and eye protection.
- Do not tilt the battery, as acid could spill out from the degassing vents.



First Aid:

- If acid splashes into the eyes rinse immediately with clear water for several minutes. Then consult a physician.
- If acid splashes onto the skin or clothes neutralise immediately by using an alkaline solution or soap and rinse with large amounts of water.
- If acid is swallowed consult a physician immediately.



Warning:

- Do not expose batteries to direct sunlight without protection.
- Always store batteries in a frost-free area, as discharged batteries can freeze.



Disposal:

- Hand in used batteries at a collection centre. During transportation take note of the instructions contained in Item 1. Never dispose of old batteries with domestic waste.

Low-temperature Test current for Starter batteries according to various standards

Low-temperature test current is a benchmark for the starting capacity of a battery at minus 18°C.

1. DIN (Deutsche Industrie Norm) DIN EN 50342

The test is carried out at minus 18°C. Following a discharge with low-temperature current I at an end voltage of 7.5 V, the discharge period should amount to at least 10 seconds.

In addition, the battery must fulfil two additional requirements.

The period up to 6 V final voltage shall amount to:

After C1: t 6 V > 90 seconds

After C2: t 6 V > 150 seconds

2. SAE (US standard)

The test is carried out at minus 18°C. With low-temperature current of up to 7.2 V, the discharge period should amount to at least 30 seconds.

$$SAE = \frac{DIN}{2} \times 3 + 40$$

3. IEC (International Electrotechnical Commission) 95-1

The test is carried out at minus 18°C. Following a discharge with the low-temperature current (I cc) after 60 seconds the voltage should amount to at least 8.4 V.

$$IEC = \frac{DIN}{0.85}$$

Reserve capacity

Following dynamo failure, reserve capacity represents the number of minutes during which a battery can supply power until the next repair shop can be reached. However, this figure is dependent upon the consumers in the vehicle. IEC envisages the following test:

Discharge with 25 A down to an end voltage of 10.5 V at a temperature of 27°C.

$$\text{Measured time in minutes} = \text{reserve capacity}$$

4. EN (Europa Norm) DIN EN 50342

The test is carried out at minus 18°C. Following a discharge with the low-temperature current I at an end voltage of 7.5 V, the discharge period should amount to at least 10 seconds.

In addition, the battery must fulfil two additional requirements.

The period up to 6 V final voltage shall amount to:

After C1: t 6 V > 90 seconds

After C2: t 6 V > 150 seconds

$$EN (C_1) = \frac{IEC}{0,6} \quad IEC = \frac{DIN}{0,85}$$

$$EN (C_2) = \frac{DIN}{0,6} \quad EN (C_1) = \frac{DIN}{0,6 \times 0,85} = \frac{DIN}{0,51}$$

As the prescribed graduations are defined in the EN, the currents are to be adjusted by rounding up or down:

- < 200 A – Level 10 A
- 200 – 300 A – Level 20 A (220, 240, 260, 280 A)
- 300 – 600 A – Level 30 A (330, 360, 390, 420, 450, 480, 510, 540, 570 A)
- 600 – 800 A – Level 40 A (640, 680, 720, 760 A)
- > 800 A – Level 50 A