



Instruction Sheet

For VARTA RL, RM, RN, RH, TP, TSP



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Observe the instructions for use and position them visibly near the battery! Only qualified personnel should work on batteries!



Cells are heavy! Make sure they are safely installed! Only use suitable transport equipment!



When working on batteries wear safety goggles and protective clothing. Remove all rings, watches and other items with metal parts before working on the battery! Only use insulated tools! Strictly observe the accident prevention regulation as well as **DIN VDE 0510, VDE 0105, Part 1**.



Risk of explosion and fire - avoid short circuits! Warning! Metal parts of the battery are always fraught with voltage, so never place objects or tools on the battery!



The electrolyte is harmful to skin and eyes, therefore, after contact wash immediately with plenty of clean water. If eyes are affected flush with water and consult a doctor immediately. Clothing contaminated by electrolyte should be washed in water immediately!



No smoking! Do not allow open fire, ember or sparks near the battery due to the risk of explosion or fire!



Electrolyte is highly corrosive!



Ni-Cd



Cd

Old batteries with this symbol are reusable products and have to be put into a recycling system. Old batteries must be disposed of as special waste in accordance with all standards and all regulations.

Do not place electrically conductive objects such as tools, etc. on the battery!
Risk of short circuit and fire!

No rings or metal bracelets should be worn during the assembly of the battery -
Risk of injury!

Open the doors of the battery cabinet during charging so that the charging gases can escape. The charging gases from batteries are explosive. Do not allow open fire or ember in the vicinity of the battery! **Risk of explosion!**

Caution - caustic potash solution is corrosive!

Caustic potash solution is used as electrolyte. Caustic potash solution is a highly corrosive liquid which can cause severe damage to health if it comes into contact with the eyes or the skin (risk of blinding). If even small quantities are swallowed there is a possibility of internal injuries.

When working with electrolyte and on cells / batteries rubber gloves, safety goggles with side guards and protective clothing must always be worn!

Contact with the eyes: Flush out immediately with copious amounts of water for 10 - 15 minutes. If necessary consult an eye clinic.

Contact with the skin: Remove splashed clothing immediately and wash the affected skin areas with copious amounts of water. For any discomforts consult a doctor.

Swallowing: Rinse out the mouth immediately with copious amounts of water and keep drinking large amounts of water. Do not provoke vomiting. Call an emergency doctor immediately.

In the event of injuries: Rinse thoroughly for a long period under running water. Consult a doctor immediately.

Warning!

The gases emitted during charging are explosive. The electrolyte (potash lye) is highly corrosive. Exposed metal parts of the battery always conduct a voltage and are electrically active parts. Precautions in accordance with **DIN VDE 0510, Part 2** have to be observed.

The Maintenance and Handling Instructions must be strictly observed. Non-compliance with the Maintenance and Handling Instructions, replacing with unoriginal spares, usage other than specified, use of additives to the electrolyte and unauthorised tampering will invalidate any entitlement to warranty.

WARNING!

Never use sulphuric acid or acidic water. Acid will damage the battery!

1. Receiving the battery

The cells are not to be stored in packaging, therefore, unpack the battery immediately after arrival. Do not overturn the package. The battery cells are equipped with a blue plastic transport plug.

The battery can be delivered:

- **Filled and charged** / the battery is ready for installation. Replace the transport plug with the vent cap included in our accessories just before use
- **Filled and discharged** / Replace the transport plug with the vent cap included in our accessories just before use
- **Unfilled and discharged** / do not remove the transport plug until ready to fill the battery.

Before any electrical operation is carried out on the new battery it has to be ensured that cells are filled with electrolyte and the transport plugs are removed from the cells and replaced by vent plugs.

2. Storage

The rooms provided for storing the batteries must be clean, dry, cool (+10°C to 30°C - in compliance with IEC 60623) and well ventilated. The cells are not to be stored in closed packaging and must not be exposed to direct sunlight or UV-radiation.

If the cells are delivered in plywood boxes, open the boxes before storage and remove the packing material on the top of the cells. If the cells are delivered on pallets remove the packing material on the top of the cells.

2.1 Uncharged and unfilled cells

Provided the correct storage conditions are met then the cells and batteries can be stored for long periods without damage if they are deeply discharged, drained and well sealed. It is very important that the cells are sealed with the plastic transport plug tightly in place. It is necessary to check the transport plug after receipt and at least every year. Leaky plugs allow the carbon dioxide from the atmosphere to infiltrate the cell, which will result in carbonation of the plates. This may influence the capacity of the battery.

2.2 Charged and filled cells/ discharged and filled cells

Filled cells can be stored for up to 12 months from the time of delivery.

Storage of filled cells at a temperature above +30°C results in loss of capacity of approximately 5% per 10°C per year. It is very important that the cells are sealed with the plastic transport plugs tightly in place. In case of loss of electrolyte during transportation, refill the cell with distilled water to the "MIN" mark before storage.

3. Installation

Battery installations have to be in accordance with EN 50272-2:2001. For non stationary installations specific standards are valid.

3.1 Location

Install the battery in a dry and clean room. Avoid direct sunlight and heat in all cases. The battery will give the optimal performance and maximum service life if the ambient temperature lies between +10°C and +30°C.

3.2 Ventilation

Before end of charge, battery can release a mixture of oxygen and hydrogen which is directly proportional to the charge current. At normal float charge the gas evolution is very small but some ventilation is necessary.

Special regulations for ventilation might be required in your area for certain applications.

3.3 Setting up

Always follow the assembly drawings, circuit diagrams and other separate instructions. The transport plugs have to be removed by the vent caps included in the accessories. If batteries are supplied "filled and charged", first of all the electrolyte level should be checked and if necessary topped up as described in point 3.4.

Cell connectors and/or flexible cables should be checked to ensure they are tightly fixed. Terminal nuts, screws and connectors must be tightly fixed. If necessary tighten with a torque wrench.

Torque loading for:

M10: 8 Nm

M16: 20 Nm

M20: 25 Nm

Female thread:

M 8: 20 - 25 Nm

M10: 25 - 30 Nm

The connectors and terminals should be corrosion-protected by coating with thin layer of anti-corrosion grease.

3.4 Electrolyte

The electrolyte for NiCd batteries is a diluted caustic potash solution (specific gravity 1.20 kg/litre ± 0.01 kg/litre) with a lithium hydroxide component, in accordance with IEC 60993. The caustic potash solution is prepared in accordance with factory regulations. The specific gravity of the electrolyte does not indicate the charging state of the battery. It changes only slightly during charging and discharging and is only minimally related to the temperature.

■ **Battery delivered unfilled and discharged** / if the electrolyte is supplied dry, it is to be mixed according to the enclosed mixing instruction. Remove the transport plugs from the cell just before filling. Fill the cells up to 20 mm above the lower level mark "MIN". Steel cased cells have to be filled up to the top edge of the plates. When using battery racks, fill cells before installing. Only use genuine electrolyte.

■ **Battery delivered filled and charged or discharged** / check electrolyte level. It should not be less than 20 mm below the upper level mark "MAX" (see 5.2).

3.5 Commissioning

A good commissioning is very important. The following instructions are valid for commissioning between 20°C to 30°C. For different conditions please contact the manufacturer. Charging at constant current is preferable. If a site test is requested it has to be carried out in accordance with IEC 60623.

According to IEC 60623, 0.2C₅A is also expressed as 0.2 I_t A. The reference test current is expressed as:

$$I_t A = \frac{C_n Ah}{1 h}$$

3.5.1 Commissioning with constant current

Battery delivered unfilled and discharged / after a period of 5 hours from filling the electrolyte, the battery should be charged for 15 hours at the rated charging current 0.2 I_t A. Approximately 4 hours after the end of charging the electrolyte level should be adjusted to the upper electrolyte level marked "MAX" by using only genuine electrolyte. For cells with steel cases the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level". **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the "MIN" mark.**

Battery delivered filled and discharged / the battery should be charged for 15 hours at the rated charging current 0.2 l A. Approximately 4 hours after the end of charging the electrolyte level should be adjusted to the upper electrolyte level marked "MAX" by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level". **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the "MIN" mark.**

Battery delivered filled and charged and stored for more than 12 months / the battery should be charged for 15 hours at the rated charging current 0.2 l A. Approximately 4 hours after the end of charging the electrolyte level should be adjusted to the upper electrolyte level marked "MAX" by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level". **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the "MIN" mark.**

Battery delivered filled and charged / a 5 hour charge at the rated charging current 0.2 l A must be carried out before setting the battery into service. Approximately 4 hours after the end of charging the electrolyte level should be adjusted to the upper electrolyte level marked "MAX" by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level". **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the "MIN" mark.**

3.5.2 Commissioning with constant voltage

If the charger's maximum voltage setting is too low to supply constant current charging, divide the battery into two parts that will be charged individually.

Battery delivered unfilled and discharged / after a period of 5 hours from filling the electrolyte, the battery should be charged for 30 hours at the rated charging voltage of 1.65 V/cell. The current limit should be 0.2 l A maximum. Approximately 4 hours after the end of charging the electrolyte level should be adjusted to the upper electrolyte level marked "MAX" by using only genuine electrolyte. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level". **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the "MIN" mark.**

Battery delivered filled and discharged / the battery should be charged for 30 hours at the rated charging voltage of 1.65 V/cell. The current limit should be 0.2 l A maximum. Approximately 4 hours after the end of charging the electrolyte level should be adjusted to the upper electrolyte level marked "MAX" by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level". **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the "MIN" mark.**

Battery delivered filled and charged and stored for more than 12 months / the battery should be charged for 30 hours at the rated charging voltage of 1.65 V/cell. The current limit should be 0.2 l A maximum. Approximately 4 hours after the end of charging the electrolyte level should be adjusted to the upper electrolyte level marked "MAX" by using distilled or deionized water in accordance

with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level". **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the "MIN" mark.**

Battery delivered filled and charged / a 10 hour charge at the rated charging voltage of 1.65 V/cell must be carried out before putting the battery into operation. The current limit should be 0.2 l A maximum. Approximately 4 hours after the end of charging the electrolyte level should be adjusted to the upper electrolyte level marked "MAX" by using distilled or deionized water in accordance with IEC 60993. For cells with steel cases, the electrolyte level should be adjusted to the maximum level according to the "Instruction for the control of electrolyte level". **During the charge the electrolyte level and temperature should be observed (see point 5.4). The electrolyte level should never fall below the "MIN" mark.**

4. Charging in operation

4.1 Continuous battery power supply (with occasional battery discharge)

Recommended charging voltage for ambient temperatures + 20°C to + 25°C

Do not remove the vent caps during float, boost charge and buffer operation. The current limit should be 0.3 l A maximum in general.

4.1.1 Two level charge

Floating: 1.40 - 1.42 V/cell **Boost charge:** 1.55 - 1.70 V/cell

A high voltage will increase the speed and efficiency of recharging the battery.

4.1.2 Single level charge: 1.45 - 1.50 V/cell

4.2 Buffer operation: Where the load exceeds the charger rating. 1.45 - 1.55 V/cell

5. Periodic Maintenance

The battery must be kept clean using only water. Do not use a wire brush or solvents of any kind. Vent caps can be rinsed in clean water if necessary but must be dried before using them again.

Check regularly (approximately every 6 months) that all connectors, nuts and screws are tightly fastened. Defective vent caps and seals should be replaced. All metal parts of the battery should be corrosion-protected by coating with a thin layer of anti-corrosion grease. **Do not coat any plastic part of the battery, for example cell cases!**

Check the charging voltage. If a battery is parallel connected it is important that the recommended charging voltage remains unchanged. The charging current in the strings should also be checked to ensure it is equal. These checks have to be carried out once a year. High water consumption of the battery is usually caused by improper voltage setting of the charger.

5.1 Equalising charge

It is recommended to carry out an equalising charge once a year to maintain capacity and to stabilise the voltage levels of the cells. The equalising charge can be carried out for 15 hours at 0.2 l A or with the boost charging stage in conformity with the characteristic curve of the available charging equipment. The electrolyte level must be checked after an equalising charge.

In order to equalise the floating derating effect it is recommended to charge the battery once a year for 15 hours at the rated charging current 0.2 l A. Then discharge the battery down to 1.0 V/cell and charge again for 8 hours at the rated charging current 0.2 l A.

5.2 Electrolyte check and topping up

Check the electrolyte level and never let the level fall below the lower level mark "MIN". Use only distilled or deionized water to top-up the cells in accordance with IEC 60993. Experience will tell the time interval between topping-up. Refilling with electrolyte is only permissible if spilled electrolyte has to be replaced. If during refilling or topping up, electrolyte has been splashed onto the cell cover or between the cell cases, clean this off and then dry the area.

NOTE: Once the battery has been filled with the correct electrolyte either at the factory or during the battery commissioning, there is no need to check the electrolyte density periodically. Interpretation of density measurements is difficult and could lead to misunderstandings.

5.3 Replacing of electrolyte

In most stationary applications the electrolyte will retain its effectiveness for the total lifetime of the battery. However, under special battery operating conditions, if the electrolyte is found to be carbonated, the battery performance can be restored by replacing the electrolyte. **Only use genuine electrolyte!**

It is recommended to change the electrolyte when reaching a carbonate content of 75 g/litre. It is possible to test the electrolyte in the manufacturer's laboratory. For this a minimum quantity of 0.2 litres of electrolyte in a clean glass or polyethylene container should be sent in, paying strict attention to the valid dangerous goods

regulations. The sample of electrolyte should be taken half an hour after charging has ended and from several cells of the battery. Do not take the samples immediately after topping up. The electrolyte sample and the cells should be closed immediately after the electrolyte has been taken.

CAUTION - caustic potash solution is corrosive!

5.4 Electrolyte temperature

The maximum recommended electrolyte temperature is 50°C. For optimal product life and performance, the recommended average temperature is $\leq 35^\circ\text{C}$. Continuous operation with electrolyte temperature $> 45^\circ\text{C}$ can impact product life and performance. Electrolyte temperature readings are to be made on one of the cells in the middle of the battery

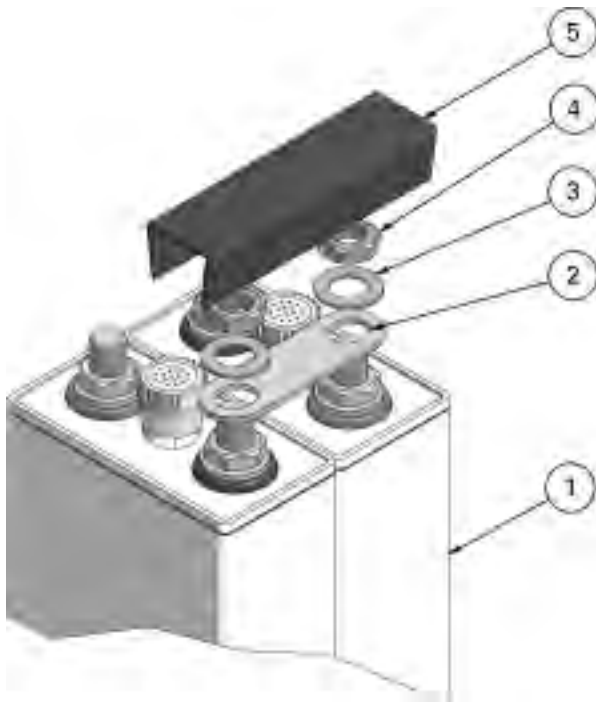
Low ambient or electrolyte temperatures down to -25°C do not have any detrimental effect on the battery. They just cause a temporary reduction in capacity.

6. Additional warning notes

NiCd batteries must not be installed or stored in the same room as lead acid batteries. In addition to this the charging gases from lead acid batteries must be kept away from Ni-Cd batteries by suitable precautions such as ventilation or hermetic isolation of the rooms. Tools for lead acid batteries must not be used for NiCd batteries.

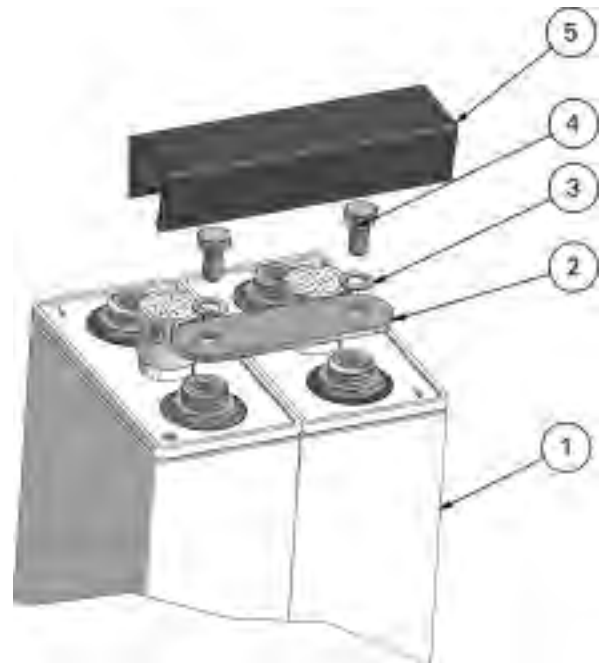
Layout details: inter unit connection

A) nut connection



- 1) cell container
- 2) cell connector
- 3) spring washer
- 4) nut
- 5) connector cover

B) screw connection



- 1) cell container
- 2) cell connector
- 3) spring washer
- 4) screw
- 5) connector cover



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