

For commissioning of unfilled batteries of the ranges FF and FT see separate instructions.

2. Operation

EN 50272-3 "Traction batteries for industrial trucks" is the standard, which applies to the operation traction batteries in industrial trucks.

2.1 Discharging

Ventilation openings must not be sealed or covered.

Electrical connections (e.g. plugs) must only be made or broken in the open circuit condition.

To achieve the optimum life for the battery, operating discharges of more than 80% of the rated capacity should be avoided (deep discharge).

This corresponds to an electrolyte specific gravity of 1.13 kg/l at the end of the discharge (**batteries of the ranges FF and FT**).

To measure the state of discharge use only the battery manufacturer recommended discharge indicators.

Discharged batteries must be recharged immediately and must not be left discharged. This also applies to partially discharged batteries. Otherwise the life of battery will be reduced.

2.2 Charging

Only direct current must be used for charging. All charging procedures in accordance with DIN 41773 and DIN 41774 are permitted.

For **batteries of the ranges GF-Y, GF-V, AS and AF-X** the charging procedure must be in accordance with DIN 41773 only. Therefore only battery manufacturer approved chargers must be used.

Only connect the battery assigned to a charger, suitable for the size of battery, in order to avoid overloading of the electric cables and contacts and unacceptable gassing of the cells.

Batteries of the ranges GF-Y, GF-V, AS and AF-X have a low gas emission.

In the gassing stage the current limits given in EN 50272-3 must not be exceeded. If the charger was not purchased together with the battery it is best to have its suitability checked by the manufacturers service department.

When charging, proper provision must be made for venting of the charging gases. Battery container lids and the covers of battery compartments must be opened or removed. The vent plugs should stay on the cells and remain closed.

With the charger switched off connect up the battery, ensuring that the polarity is correct (positive to positive, negative to negative). Now switch on the charger.

When charging the temperature of the battery rises by about 10 K, so charging should only begin if the battery temperature is below 35 °C (**batteries of the ranges GF-Y, GF-V, AS and AF-X**) or 45 °C (**batteries of the ranges FF and FT**). The electrolyte temperature of batteries should be at least 15 °C (**batteries of the ranges GF-Y, GF-V, AS and AF-X**) or 10 °C (**batteries of the ranges FF and FT**) before charging. Otherwise a full charge will not be achieved.

For **batteries of the ranges GF-Y, GF-V, AS and AF-X** a charge is finished when the specific gravity of the electrolyte and the battery voltage have remained constant for two hours.

For **batteries of the ranges GF-Y, GF-V, AS and AF-X** only regulated chargers are permitted. These chargers switch off automatically.

Are the temperatures a longer time higher than 40 °C or lower than 15 °C, so the chargers need a temperatures regulated voltage. (Attend to instructions of battery manufacturer).

2.3 Equalising charge

Equalising charges are used to safeguard the life of the battery and to maintain its capacity. They are necessary after deep discharges, repeated incomplete recharges and charges to an IU characteristic curve. Equalising charges are carried out following normal charging.

For equalising charge of **batteries of the ranges GF-Y, GF-V, AS and AF-X** only battery manufacturer approved chargers must be used.

For **batteries of the ranges FF and FT** the charging current must not exceed 5 A/100 Ah of rated capacity (end of charge – see point 2.2).

Watch the temperature!

2.4 Temperature

An electrolyte temperature of 30 °C is specified as the rated temperature. Higher temperatures shorten the life of the battery, lower temperatures reduce the capacity available.

45 °C (**batteries of the ranges GF-Y, GF-V, AS and AF-X**) or 55 °C (**batteries of the ranges FF and FT**) is the upper temperature limit and is not acceptable as an operating temperature.

Therefore the batteries should not be left in directly sunlight.

2.5 Electrolyte

Batteries of the ranges GF-Y, GF-V, AS and AF-X: The electrolyte is immobilised. The density of the electrolyte cannot be measured.

Batteries of the ranges FF and FT: The rated specific gravity (S. G.) of the electrolyte is related to a temperature of 30 °C and the nominal electrolyte level in the cell in fully charged condition. Higher temperatures reduce the specified gravity of the electrolyte, lower temperatures increase it. The temperature correction factor is -0.0007 kg/l per K, e.g. an electrolyte specific gravity of 1.28 kg/l at 45 °C corresponds to an S.G. of 1.29 kg/l at 30 °C. The electrolyte must conform to the purity regulations in DIN 43530-2.

3. Maintenance

Do not refill with water in batteries of the ranges GF-Y, GF-V, AS and AF-X!

3.1 Daily

Charge the battery immediately after every discharge.

Batteries of the ranges FF and FT: Towards the end of charge the electrolyte level should be checked and if necessary topped up to the specified level with purified water. The electrolyte level must not fall below the top of the separator or the electrolyte "min." level mark.

3.2 Weekly

Visual inspection after recharging for signs of dirt and mechanical damage. If the battery is charged regularly with an IU characteristic curve an equalising charge must be carried out (see point 2.3).

3.3 Monthly (only batteries of the ranges FF and FT)

At the end of the charge the voltages of all cells or bloc batteries should be measured with the charger switched on, and recorded. After charging has ended the specific gravity and the temperature of the electrolyte in all cells should be measured and recorded. If significant changes from earlier measurements or differences between the cells or bloc batteries are found further testing and maintenance by the service department should be requested.

3.4 Quarterly (batteries of the ranges GF-Y, GF-V, AS and AF-X)

After the end of the charge and a rest time of 5 h following should be measured and recorded:

- the voltages of the battery
- the voltages of every cells or blocs

If significant changes from earlier measurements or differences between single bloc batteries are found, further testing and maintenance by the service department should be requested.

3.5 Annually (only for batteries in steel trays)

In accordance with EN 1175-1 at least once per year, an electrical specialist must check the insulation resistance of the truck and the battery.

The tests on the insulation resistance of the battery must be conducted in accordance with EN 1987-1.

The insulation resistance of the battery thus determined must not be below a value of 50 Ω per Volt of nominal voltage, in compliance with EN 50272-3.

For batteries up to 20 V nominal voltage the minimum value is 1000 Ω.

4. Care of the battery

The battery should always be kept clean and dry to prevent tracking currents. Cleaning must be done in accordance with the ZVEI code of practice "Cleaning of batteries".

5. Storage

If batteries are taken out of service for a lengthy period they should be stored in the fully charged condition in a dry, frost-free room. To ensure the battery is always ready for use a choice of charging methods can be made:

- a quarterly (**batteries of the ranges FF and FT**) or a yearly (**batteries of the ranges GF-Y, GF-V, AS and AF-X**) full charging like charge as in point 2.2. If any consumer is connected with, e.g. measure or controlling systems, it can be, that this charging is necessary every 14 days.
- float charging at a charging voltage of 2.25 V (**batteries of the ranges FF and FT**) or 2,3 V (**batteries of the ranges GF-Y, GF-V, AS and AF-X**) x the number of cells.

The storage time should be taken into account when considering the life of the battery.

6. Malfunctions

If malfunctions are found on the battery or the charger our service department should be called without delay. The measurements taken in point 3.3 will facilitate fault finding and their elimination. A service contract with us will make it easier to detect and correct faults in good time.

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