



PerfectRail™

Battery



OWNER'S MANUAL



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INTRODUCTION



PerfectRail™

Batteries

The information contained in this document is critical for safe handling and proper use of the PerfectRail™ batteries. It contains a global system specification as well as related safety measures, codes of behavior, a guideline for commissioning and recommended maintenance. This document must be retained and available for users working with and responsible for the battery. All users are responsible for ensuring that all applications of the system are appropriate and safe, based on conditions anticipated or encountered during operation.

This owner's manual contains important safety instructions. Read and understand the sections on safety and operation of the battery before operating the battery and the equipment into which it is installed.

It is the owner's responsibility to ensure the use of the documentation and any activities related thereto, and to follow all legal requirements applicable to themselves and the applications in the respective countries.

This owner's manual is not intended to substitute for any training on handling and operating the PerfectRail™ batteries that may be required by local laws and/or industry standards. Proper instruction and training of all users must be ensured prior to any contact with the battery system.

For service, contact your sales representative or call:

EnerSys EMEA

EH Europe GmbH
Baarerstrasse 18
6300 Zug, Switzerland
Tel: +41 44 215 74 10

EnerSys World Headquarters

2366 Bernville Road
Reading, PA 19605, USA
Tel: +1-610-208-1991
+1-800-538-3627

EnerSys APAC

No. 85, Tuas Avenue 1
Singapore 639518
+65 6558 7333

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Your Safety and the Safety of others is Very Important

⚠ WARNING You can be killed or seriously injured if you don't follow these instructions.

RATING DATA & SAFETY

Railway batteries with positive tubular plates type PzS/PzSL and PzB/ PzBE*

Rating Data

- | | |
|--|-------------------------------------|
| 1. Nominal capacity C_5 : | See type plate |
| 2. Nominal voltage: | 2.0 V x No of cells |
| 3. Discharge current | $C_5/5h$ |
| 4. Nominal specific gravity (S.G.) of electrolyte* | See type plate |
| 5. Rated temperature | 30°C |
| 6. Nominal electrolyte level | Up to electrolyte level mark "max." |

*Will be reached within the first 10 cycles.

PerfectRail™ batteries are valve-regulated. Instead of a vent plug, a valve is used to regulate the internal gas pressure, preventing the ingress of oxygen from the air and allowing the escape

of excess charging gases. PerfectRail™ battery valves should never be removed. These batteries need to be topped with water.

Safety Precautions



- Pay attention to the operating instructions and keep them close to the battery.
- Work on batteries must only be carried out by skilled personnel!



- Wear protective glasses and wear safety clothing when working on batteries.
- Adhere to the current accident prevention rules in the country where the battery is used or EN 62485-3, EN 50110-1.



- No smoking!
- Do not expose batteries to naked flames, glowing embers, or sparks, as it may cause the battery to explode.



- Acid splashes in the eyes or on the skin must be washed immediately with an abundance of clean water. After abundant flushing consult a doctor immediately!
- Clothing contaminated by acid should be washed in water.



- Risk of explosion and fire!
- Avoid short circuits.
- **Caution:** metal parts of the battery are always live. Do not place tools or other metal objects on the battery!

Safety Precautions (cont.)



- Electrolyte is highly corrosive.



- Batteries and cells are heavy. Ensure secure installation! Use only suitable handling equipment e.g. lifting gear in accordance with VDI 3616.
- Lifting hooks must not damage the cells connectors or cables.



- Dangerous electrical voltage!

Ignoring the operating instructions, repair with non-original parts, and disconnection of the easy control will render the warranty void. All the failures, malfunctions, or defaults of the battery, the charger, or any other accessories, must be reported to EnerSys® Service.

*Also applies to train lighting batteries to DIN 43579 and batteries to DIN 43582.

Commissioning

For commissioning of unfilled batteries see separate instructions!

The battery should be inspected to ensure it is in perfect mechanical condition. The battery and charger cables must be connected to ensure good contact, taking care that the polarity is correct. Otherwise, the battery, vehicle, or charger may be damaged. The specified torque loading for the polescrews of the connector cables is:

	Brass	Steel
M 10	20 ± 1 Nm	25 ± 2 Nm

The level of the electrolyte must be checked. If it is below the antisurge baffle or the top of the separator it must first be topped up to this height with purified water (DIN 43530 part 4).

The battery is then charged as in the “Charging” section.

Attention:

If the time period between the delivery date and commissioning of the battery is more than 4 weeks, the battery must be charged (see Storage section). The electrolyte should be topped up to the specified level with purified water.

NOTE: If, while putting trains into operation (adjusting or checking of the electrical loads), the batteries were discharged, ensure that the battery is fully charged on an external charger before delivery of the vehicle. The nominal density of the electrolyte must be reached.

OPERATION, DISCHARGING, & CHARGING

Operation

EN 62485-3 "Safety requirements for secondary batteries and battery installations Part 3: Traction batteries" is the standard that applies to the operation of traction batteries in powered locomotives.

Discharging

Be sure that no ventilation holes are 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 must be avoided (deep discharge). This corresponds to an electrolyte specific gravity

of 1.13 kg/l at the end of the discharge. Lower S.G. shows a deep discharge of the batteries. In this case, the batteries must be recharged on an external charger.

Discharged batteries must be recharged immediately and must not be left discharged. This also applies to partially discharged batteries.

Charging

Only direct current must be used for charging.

Characteristic curve in the rail vehicle:
IU0U, temperature compensated, with the following limits:

$I_n = ca. I_5$, $U_1 = 2,37$ v/c ($T_e = +30^\circ C$), temperature correction factor 4 mv/ $^\circ C$, $U_2 = 2,25$ v/c without temperature compensation.

Only connect the battery assigned to a charger, suitable for the size of the battery, in order to avoid overloading the electric cables and contacts, unacceptable gassing, and the escape of electrolyte from the cells. In the gassing stage, the current limits listed in DIN EN 62485-3 must not be exceeded. If the charger was not purchased together with the battery, it is best to have its suitability checked by the manufacturer's service department.

When charging, proper provision must be made for venting 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.

Characteristic curves outside the vehicle:

IUIa with:

$I_n = ca I_5$, $U_1 = 2,4$ v/c ($T_e = +30^\circ C$), $I_2 = max$ 5A/100Ah, charging factor = 1,2.

The alternative can be used Wa or WoWa characteristic curves.

With the charger switched off, connect 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 electrolyte rises by about $10^\circ C$, so charging should only begin if the electrolyte temperature is below $45^\circ C$.

The electrolyte temperature of batteries should be at least $+10^\circ C$ before charging, otherwise a full charge will not be achieved. A charge is finished when the specific gravity of the electrolyte and the battery voltage have remained constant for two hours.

CHARGE ELECTROLYTE, & CARE

Charging (cont.)

During charging and subsequent gassing, the container lids must be removed or opened so that the explosive mixture of gases is diluted due to adequate ventilation.

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.

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. The charging current must not exceed 5 A/100 Ah of rated capacity (end of charge—see Charging section). The equalising charges must be done outside the vehicle in a charging room with good ventilation.

Carefully monitor the temperature!

Temperature

An electrolyte temperature of 30°C is specified as the rated temperature. Higher temperatures shorten the life of the battery, and lower temperatures reduce the capacity available. 55°C is the upper temperature limit and is not acceptable as an operating temperature.

Electrolyte

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.

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 (German Electrical and Electronic Manufacturers' Association) code of practice "The Cleaning of Vehicle Traction Batteries"

Any liquid in the battery tray must be extracted and disposed of in the prescribed manner. Damage to the insulation of the tray should be repaired after cleaning, to ensure that the insulation value complies with DIN EN 62485-3 and to prevent tray corrosion.

MAINTENANCE & STORAGE

Maintenance

Recommended maintenance intervals for PerfectRail™ batteries include:

- Visual control of the battery (damage, type indicator, end poles, connectors, cleanness, electrolyte level, battery tray).
- Cell voltages must be recorded, including spot checking the specific gravity of the electrolyte. If the measured value corresponds to a deeply discharged battery, this must be recharged on an external charger.
- Electrolyte level must be checked every 3 months (or, at higher temperatures, monthly). The electrolyte level must not fall below the anti-surge baffle, the top of the separator, or the electrolyte "min" level mark. At lower levels, it must be

refilled with purified water according to DIN 43530 part 4. If the battery is discharged, refill only to the "min" level mark. After the battery is recharged, it must be refilled to the "max" level mark.

- In accordance with DIN EN 1175-1, at least once per year, the insulation resistance of the vehicle and the battery must be checked by an electrical specialist.

The insulation resistance tests of the battery must be conducted in accordance with DIN 1987-1. The insulation resistance of the battery thus determined must not be below a value of 50Ω per volt of nominal voltage, in compliance with DIN EN 62485-3. For batteries up to 20V nominal voltage, the minimum value is 1000Ω .

Storage

If batteries are taken out of service for a lengthy period, they should be stored in the fully charged condition in a dry, cool, frost-free room.

Do not expose the batteries to direct sunlight.

To ensure the battery is always ready for use, choose one of the following charging methods:

- A monthly equalising charge as in the Equalising Charge section
- Float charging at a charging voltage of $2.25V \times$ the number of cells. The storage time should be taken into account when considering the life of the battery.



Battery must be recycled



Environmental Risk!

Risk of lead pollution.

Back to the manufacturer!

Batteries with this sign must be recycled.

Batteries which are not returned for the recycling process must be disposed of as hazardous waste!

When using motive power batteries and chargers, the operator must comply with the current standards, laws, rules, and regulations in force in the country of use!

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