



PerfectRail™ DS Battery



OWNER'S MANUAL



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INTRODUCTION



PerfectRail™ DS Battery

The information contained in this document is critical for safe handling and proper use of the PerfectRail™ DS battery. It contains a global system specification as well as related safety measures, codes of behaviour, 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 their respective countries.

This owner's manual is not intended to substitute for any training on handling and operating the PerfectRail™ DS 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:

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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

Rail engine starting flooded, flat plate, Pb-1.7%Sb/Pb-1.7%Sb 12V monoblocs.

Rating Data

1. Nominal capacity C_5 :	See type plate
2. Nominal voltage:	See type plate
3. Discharge current	See type plate
4. Nominal specific gravity (S.G.) of electrolyte	1.29 kg/l
5. Rated temperature	25°C

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!



- Use 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.



- Keep children away from batteries!



- No smoking!
- Do not expose batteries to naked flames, glowing embers, or sparks, as it may cause the battery to explode.
- Avoid sparks from cables or electrical apparatus as well as electrostatic discharges.



- 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: do not use non-insulated tools, do not place or drop metal objects on top of the battery. Remove rings, wristwatches, and articles of clothing with metal parts that might come into contact with the battery terminals.



- Electrolyte is highly corrosive.

SAFETY & COMMISSIONING

Safety Precautions (cont.)



- Do not tip the battery over.
- Batteries and monoblocs are heavy. Ensure secure installation! Only use suitable handling equipment. Lifting hooks must not damage the blocs, connectors, or cables.
- Do not place batteries in direct sunlight without protection.
- Discharged batteries can freeze. For that reason, always store in a frost-free zone.



- Dangerous electrical voltage!



- Pay attention to the hazards that can be caused by batteries.

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.

Commissioning

The battery should be inspected to ensure it is in perfect physical condition.

Check:

1. the battery cleanliness. Before installing the battery compartment has to be cleaned.
2. the battery end cables have good contact to the terminals and the polarity is correct. Otherwise battery, vehicle or charger could be destroyed.
3. the electrolyte level. The electrolyte level must always be above the top of the separators.

Top up with demineralised water to the nominal level. Charge the battery (see "Equalising charge" section) before commissioning. Only blocs with the same state of discharge (the same voltage and tolerance, as shown in the following table) should be connected together.

Bloc voltage (V)	Max. tolerance from average value - ΔU_{bloc}
12	± 0.049

After connecting, the terminals must be covered with grease as protection against corrosion.

The specified torque loading for the bolts/screws of the end cables and connectors are:

DIN conic post
$8 \pm 1 \text{ Nm}$

OPERATION

Operation

The nominal operating battery temperature is 25°C. Higher temperatures shorten the life of the battery, lower temperatures reduce the available capacity. 55°C is the upper temperature limit and batteries should not be used above this operating temperature. The capacity of the battery changes with temperature and falls considerably under

0°C. The optimum lifetime of the battery depends on the operating conditions (moderate temperature and discharges equal to or lower than 80% of the nominal capacity C5). The battery obtains its full capacity after about 10 charging and discharging cycles.

Discharging

Vent plugs on the battery 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).

A minimum S.G. of the electrolyte of 1.13 kg/l must be checked at the end of the discharge. Discharged batteries must be recharged

immediately and must not be left in a discharged condition:

Discharge	Recharge
>40%	Every day
<40%	Every second day

This also applies to partially discharged batteries. Discharged batteries can freeze.

Charging

PerfectRail™ DS batteries can be recharged with a 50 Hz or HF charger. If you wish to use an existing charger with Wa, WoWa, IU1a, or WU1a profile, you should check that the profile is approved by our Technical Department. Only direct current must be used for charging. Only connect the battery to the correctly assigned charger, suitable for the battery size, in order to avoid overloading the electric cables and contacts, electrolyte overflow, and unacceptable gassing of the cells.

When gassing, the current limits must not be exceeded according to DIN EN 62485-3. Before starting the charge, make sure of:

- the presence of the plugs.
- In the case of the water refilling system, check the good condition of the filling-up circuit and specific plugs and the water tube connection for the filling device (fast connection between the battery and the system with water supply).

Charging (cont.)

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. Keep vent plugs closed. 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. In the case of automatic filling, with manual command, press the push-button of the electro-valve box to release the supply of demineralised water at the end of the charge. When charging, the temperature of the battery rises by about 10°C, so charging

should only begin if the electrolyte temperature is below 45°C. The electrolyte temperature of the battery should be at least +10°C before charging, otherwise, a full charge will not be achieved without specific settings of the charger. The charge is considered as achieved when the electrolyte S.G. and the battery voltage remain constant for 2 hours. During the recharge, the cells emit hydrogen and oxygen gas. It is necessary to ensure ventilation in the room, especially during the recharge. All installations must comply with the current regulations in force in the country of operation.

Normal Charge

It is applied further to a normal discharge of the battery (up to 80% of C5). It is not interrupted until the end of charge indication by the charger display. It is not necessary to recharge the battery immediately

if, after a use cycle, the residual capacity is still more than or equal to 60% of its capacity.

In that case, it is necessary to recharge the day after at the latest.

Equalising Charge

Equalising charges are used to ensure the service life and to maintain the capacity. They are necessary after deep discharges and after repeated uncompleted charges. They allow homogenisation of the specific gravity of the electrolyte:

- to compensate for the self-discharge due to the storage period
- to compensate for the eventual lack of charge with normal charges
- to quickly homogenise the electrolyte, following the addition of distilled or demineralised water
- to compensate for stratification, following partial charges without mixing of the electrolyte (not recommended).

To be carried out after a normal charge when a variation (difference of more than 10 grams per litre) of specific gravity is recorded. It is carried out using a constant current with a low value near C5/30 (C5/20 max) and after a normal charge of the battery (end of charge, see Charging section). The recommended duration is 8 hours. The equalising charge may be interrupted if the specific gravities are homogenised. When the nominal electrolyte specific gravity is not obtained after an equalising charge, and when this low specific gravity is not the consequence of electrolyte overflowing, a recharge in completion with the equalising charge can be carried out. It must be done with constant current, near C5/60 A, and after a complete charge for 72 hours. Watch the temperature and ensure sufficient ventilation!

MAINTENANCE

Desulphation Charge

Should be carried out after a very deep discharge of the battery (> 80% C5) when the charger does not start the recharge due to an over-discharge of the battery. It must be carried out with constant current, near C5/60, for 2 hours minimum. It is followed by a normal charge and an equalising charge (desulphation if necessary). The best result is obtained with the lowest value of current. In any case, stop the charge if the electrolyte temperature reaches 45°C.

Electrolyte

The electrolyte nominal S.G. is 1.29 kg/l at 25°C when in fully charged condition. According to temperature, S.G. correction, with respect to 25°C, will be applied:

T °C	Correction per °C
If T °C > 25°C	- 0,0007
If T °C < 25°C	+ 0,0007

Example: S.G. reading 1.282 at 36°C:

$1.282 + (0,0007 \times 11) = 1.289$ at 25°C

The purity of the electrolyte must correspond to DIN 43530-2.

Battery Check

After a normal charge, measure:

- the total voltage
- the voltage per cell
- the electrolyte-specific gravity on several cells or on the whole battery.

NB: measure at the constant intensity of $I=0.033 C5$ or if the charger can do it, at "equalising charge"

The voltages for a new battery will be greater than or equal to 2.65 volts per cell under $I=0,033 C5$.

Maintenance

Annually

Battery: for bolt-on connectors, check the torque settings of the terminal bolts/screws; the terminals must be covered with grease as protection against external corrosion. **Charger:** internal dust removal, check all connections (plugs, cables, and contacts) and charging parameters. At least once a year, the insulation resistance of the locomotives and of the battery must be checked by an electrical specialist.

The test on the insulation resistance of the battery must be conducted in accordance with DIN EN 1987-1. The average insulation resistance of the battery must not be lower than 50Ω per volt nominal voltage (DIN EN 62485-3) For batteries up to 20 V nominal voltage the minimum value is 1000Ω.

STORAGE

Storage and Transportation

Batteries must always be stored and transported securely in the vertical position in order to avoid any electrolyte leakage. Store the battery in a fully charged condition in a dry, clean, and frost-free area. Always disconnect the battery from the electric vehicle before storage. For easy recharge of the batteries, it is advised not to store without recharge for more than 3 months at 20°C and 2 months at 30°C.

The storage time is to be considered within the battery life expectancy. To ensure the battery is always ready for use, a choice of charging methods can be made:

- Monthly equalising charge according to the “Equalising Charge” section.
- Float charge with 2.27 V x number of cells.



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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