



rail | power line

Energy storage
for railway applications

Energy storage

for railway applications

All storage technologies from a single source

Since 30 years HOPPECKE has been your partner for efficient systems solutions in the railway sector and is best prepared for the requirements of the future. One partner for all technologies – this means the best solution for every customer requirement.

HOPPECKE provides:

- Lead-acid batteries widely used in the railway sector.
- Proven and still unique FNC technology.
- For trend-setting developments in the railway sector, HOPPECKE keeps ready innovative developments of Li-Ion battery systems.

Certifications

The HOPPECKE products are manufactured in due consideration of the international standards for quality, safety and environment.

For every application the right battery

HOPPECKE offers a wide range of cells, batteries and complete solutions, which are used in the most varied applications for rail vehicles and in power ranges required in the national and international rail use. The installation options are manifold, whether it is roof assembly or underfloor installation or installation inside the train – we construct and manufacture your individual energy system.

Quality/Safety:

- ISO 9001
- IRIS ISO / TS 22163
- OHSAS 18001
- EN 50126
- EN 50128 / EN 50129
- EN 50155
- IEC 60077
- EN 50121-3-1

Performance:

- IEC 60623
- UIC 854
- IEC 60254
- IEC 60896
- GOST

Mechanics:

- EN 12663
- IEC 61373
- EN 15085, ASTM

Fire Safety:

- EN 45545
- NFPA 130
- UL 94

Environment:

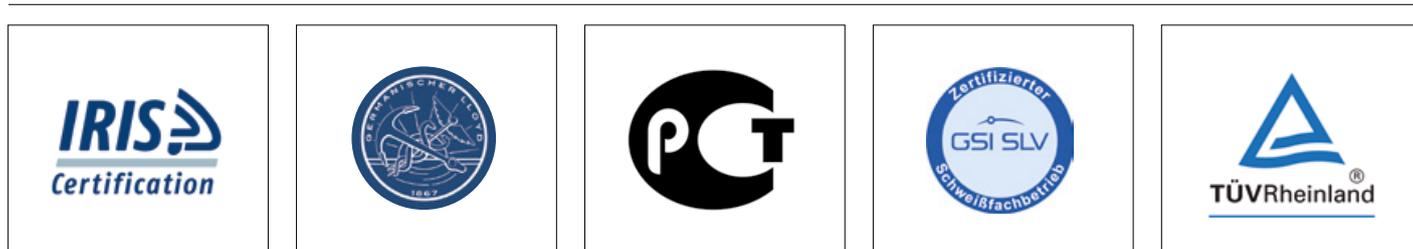
- ISO 14001





rail | power

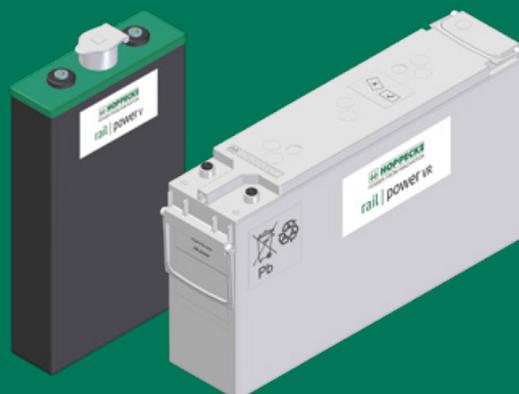
The HOPPECKE battery technologies



rail | power

Lead-acid technology

- Cost efficient battery for standard rail auxiliary supply
- Advanced HOPPECKE Standard in quality and technology
- Complete systems with vented or valve regulated batteries (VRLA)



rail | power FNC

NiCd technology

- Technologically advanced battery for demanding requirements
- Longer life and higher cyclic endurance for railway applications even under conditions of extreme temperature
- Wide variety of energy-to-power ratios for optimum adaptation to customers' needs

rail | power LiIon

Li-Ion technology

- Highest energy and power density
- High cycle life for both full and partial cycles
- Extremely low self-discharge



rail | power

Valve regulated lead-acid battery

Established and proven technology for railway vehicles

Gas- and electrolyte-tight terminals as well as the integrated back-fire protection assure an optimal operational safety. The use of HOPPECKE system connectors, which in the assembly stage already provide increased short-circuit security, contribute to this. The plastic-insulated lead-poles contain brass inlets and thus assure the good high-current capability. The batteries are built in cases of stable polypropylene or ABS. They are resistant against shock and vibration stress, which are well beyond the relevant requirements for rail batteries.

Series

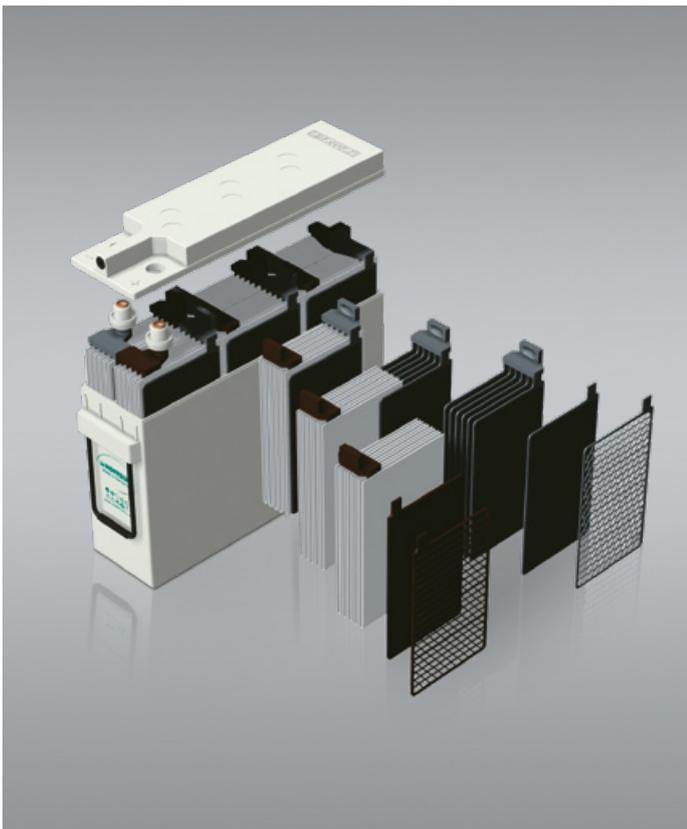
rail | power V

Vented lead-acid battery

rail | power V is a long proven technology based on tubular and grid plate electrodes and liquid electrolyte. The electrodes are made of lead-antimony technology. The batteries are built in cases of stable polypropylene. rail | power V work reliably as on-board electrical system batteries in all rail vehicles.

Your advantages with HOPPECKE

- Available in 6 V and 12 V block battery and 2 V individual cell
- Usable without problems in the temperature range from -20°C to $+55^{\circ}\text{C}$
- Resistant to deep discharge
- Design life for 15 years, service life in rail application up to 8 years
- High cycle stability, more than 1,500 cycles





Series

rail | power VR

Valve regulated lead-acid battery

Innovative Gel- ESS battery technology

Patented technology on the basis of grid electrodes and a fleece separator. The electrodes are produced with the proven lead-calcium technology. The electrolyte contains gel additives (ESS-technology) and is laid down in the fleece-separator. In this way this technology does not only possess the advantages of the fleece-battery but also those of the gel-battery.

The batteries are built in cases of stable polypropylene or ABS. rail | power VR batteries work reliably as on-board electrical system batteries in all rail vehicles. They are also used as starter battery in diesel vehicles.

Norms/Standards:

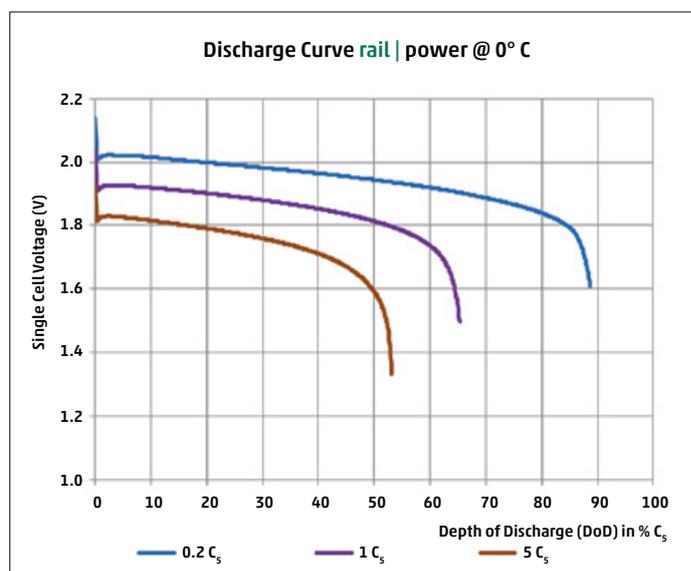
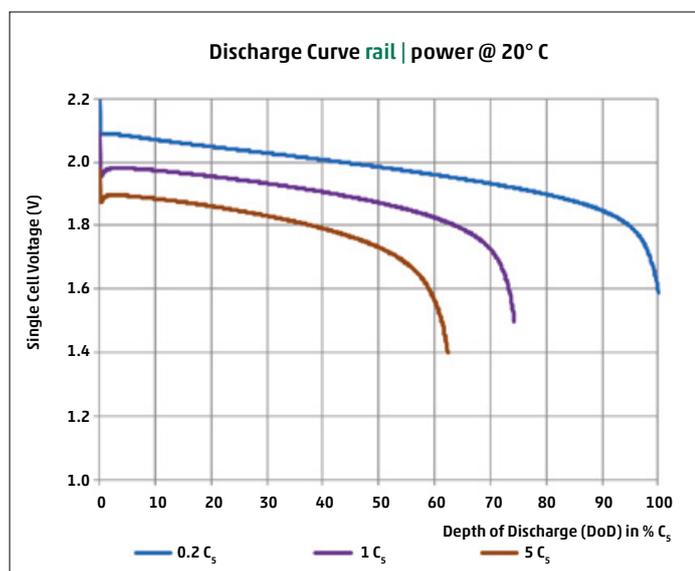
- EN 60254
- IEC EN 61373

Your advantages with HOPPECKE

- Available in 6 V and 12 V block battery and 2 V individual cell
- Maintenance-free regarding water refilling, highest security over the whole life
- Integrated backfire protection guarantees optimal operational safety
- Usable without problems in the temperature range from -20°C to $+45^{\circ}\text{C}$
- Resistant to deep discharge
- No „thermal runaway“, no electrolyte coating thanks to ESS
- Design life 12 years+, service life in rail application up to 6 years
- High cycle stability, more than 1,500 cycles

Norms/Standards:

- IEC EN 60896-21/22
- IEC EN 61373
- UL94



Important: These curves are only examples for the discharge performance. They must not be used for sizing batteries.

rail | power FNC

Unparalleled Worldwide – FNC® technology

Since 1983 HOPPECKE has shipped more than 2.5 million FNC® cells to railway clients around the world. This success is based on the many benefits of FNC® technology compared to other energy storage systems.

Your advantages with HOPPECKE

- Reliable energy supply – due to extremely high cycle stability
- Long service life – due to the HOPPECKE quality standard
- Maximum safety – through superior technology
- Temperature resistant – by best properties under extreme temperature conditions
- Low follow-up costs – due to long maintenance intervals

Series

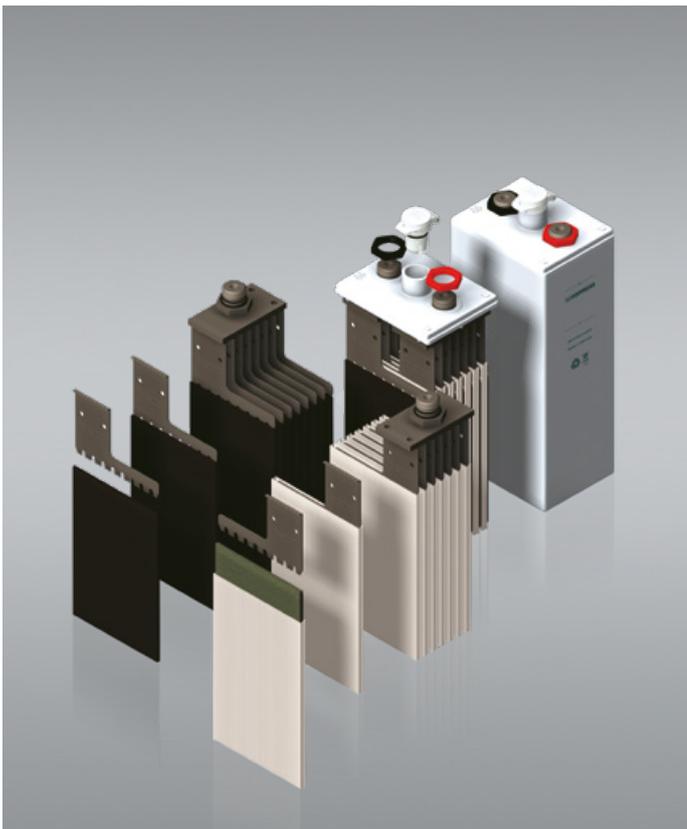
rail | power FNC V

Standard series for all applications

No other NiCd technology is better suited for the production of special formats than the fibre structure technology. Its enormous versatility enables us to meet many individual requirements of our customers.

Your advantages with HOPPECKE

- Can be used universally in the railway sector as starter, traction or on-board electrical system battery
- Available with and without automatic filling system
- Variable cell design:
 - High, wide but very narrow
 - Small cells with a large surface area
 - Very compact, low cell





Series

rail | power FNC VA

Advanced FNC® line of products with internal recombination, extended service cycles

Your advantages with HOPPECKE

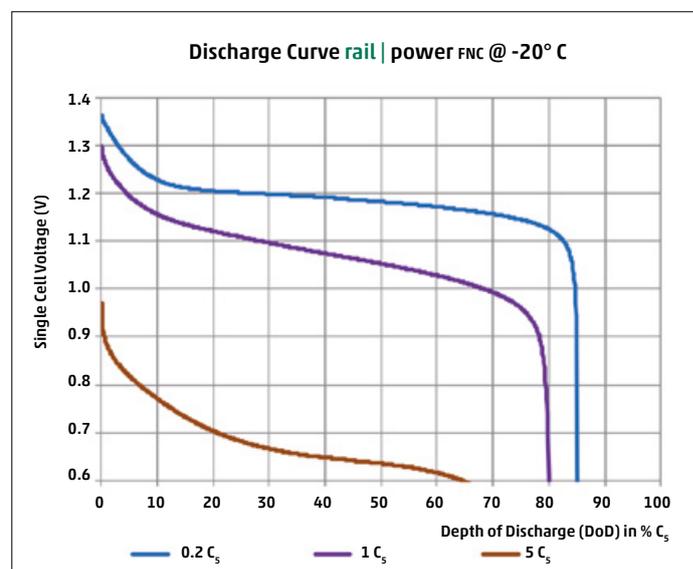
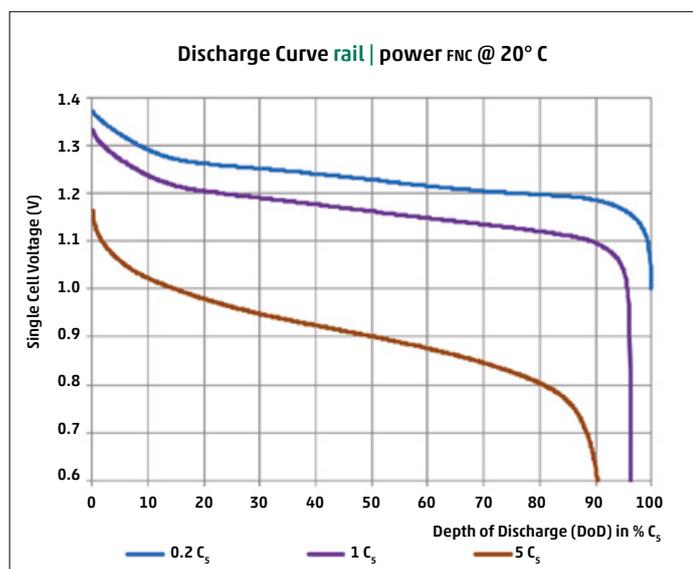
- Lower charging voltage
- Can be used in the high-current range, for hybrid drive and for starting applications
- With all of the benefits of FNC V technology and in addition:
 - Improved charge acceptance, higher energy density
 - Lower water consumption, extended maintenance intervals
 - Compact and sturdy design
 - High mechanical stability of all electrochemically active component parts
 - Much longer service life even under the hardest operating conditions

rail | power FNC VC

Compact FNC® line of products with energy density for use where space is restricted

Your advantages with HOPPECKE

- Lower charging voltage
- For all train and mass transport applications calling for maximum performance and capacity
- Offering all of the benefits of FNC VA technology plus
 - Energy density boosted once again at minimum weight



Important: These curves are only examples for the discharge performance. They must not be used for sizing batteries.

rail | power LiOn

The highest energy density combined with maximum performance

HOPPECKE lithium-ion battery systems have a modular structure. The basic units are designed in such a way that they can be used installed as a group consisting of several modules to form a larger battery system. The lithium-ion modules are available in High Energy (with high energy content) or High Power (with high power density) versions.

Your advantages with HOPPECKE

- Highly flexible due to modular system structure
- Highest possible level of operational safety thanks to integrated HOPPECKE battery management system
- Long cycle life – up to 3,500 cycles at 80% depth of discharge
- Compact dimensions and lightweight structure due to high energy and power density
- Excellent failure safety through intelligent parallel connection of modules

HOPPECKE lithium-ion basic modules have to pass extremely strict quality controls. Moreover, HOPPECKE lithium-ion modules are also UN38.3 (“Transport of lithium batteries”) and CE certified. Working closely with various certification bodies and test laboratories allows us to achieve application-specific system certifications for you. High IP protection classes can be achieved through the design and construction of suitable outer packaging (tubs, containers).





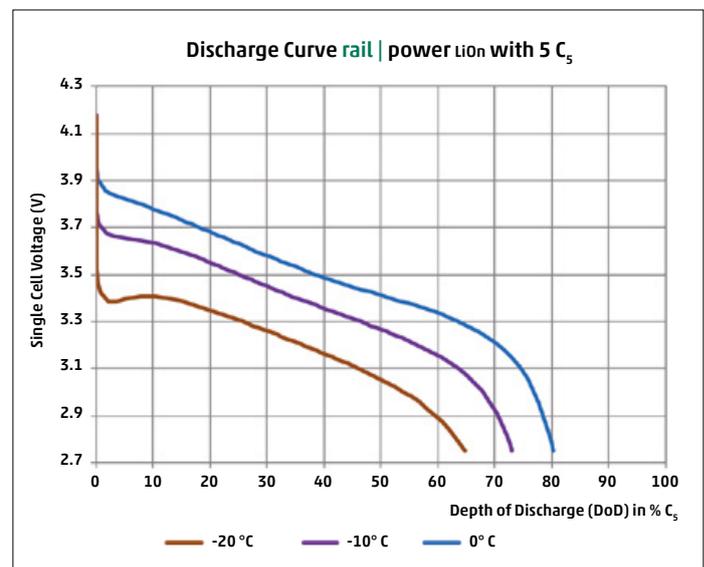
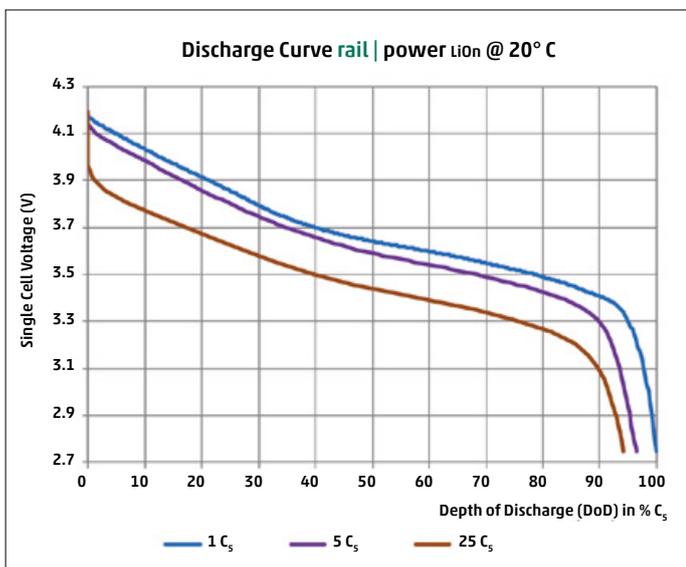
Series

rail | power LiOn 133 V

Standard basic modules specifically for applications with high system voltages

Your advantages with HOPPECKE

- Capable of modular interconnection to battery systems up to MWh
- Integrated battery management system
- Voltage-proof up to 1,000 V
- Quick chargeable, with a high load capacity
- Active and passive heating or cooling for optimal performance



Important: These curves are only examples for the discharge performance. They must not be used for sizing batteries.

Series overview

Cells and batteries

rail | power v

Vented lead-acid battery



rail | power v L 2V

Dimensions L [mm]	47 up to 191
W [mm]	198
H [mm]	370 up to 432
Capacity [Ah]	120 up to 800
Weight [kg]	8.0 up to 42.4

rail | power VR

Valve regulated lead-acid battery

Innovative Gel- ESS battery technology



rail | power VR M 12 V

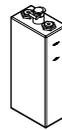
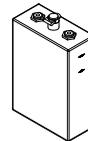
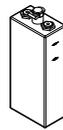
rail | power VR M 12 V FT
(front connector)

rail | power VR M 6 V

rail | power VR M 2 V

Dimensions L [mm]	267 up to 344	541	242 up to 308	88,5 up to 181
W [mm]	170 up to 177	125	170	154 up to 181
H [mm]	190 up to 275	217 up to 302	275	310
Capacity [Ah]	58 up to 113	105 up to 168	170 up to 220	238 up to 417
Weight [kg]	23 up to 42.3	39 up to 59.8	32.7 up to 44.6	15.1 up to 25.8

rail | power FNC V
FNC (NiCd) - Standard series for all applications

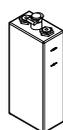


Dimensions L [mm] W [mm] H [mm]	39 up to 115 122 309	92 up to 115 194 309	77 up to 157 158 405
Performance L	rail power FNC V L 2	rail power FNC V L 3	rail power FNC V L 4
Capacity [Ah]	40 up to 220	200 up to 370	150 up to 560
Weight [kg]	2.15 up to 6.8	8.45 up to 11.1	7.35 up to 16.9
Performance M	rail power FNC V M 2	rail power FNC V M 3	rail power FNC V M 4
Capacity [Ah]	40 up to 200	200 up to 335	150 up to 490
Weight [kg]	2.15 up to 7.0	8.7 up to 11.45	7.7 up to 17.1
Performance H	rail power FNC V H 2	rail power FNC V H 3	
Capacity [Ah]	35 up to 150	140 up to 265	
Weight [kg]	2.3 up to 7.5	8.45 up to 11.5	
Performance X	rail power FNC V X 2	rail power FNC V X 3	
Capacity [Ah]	25 up to 115	130 up to 200	
Weight [kg]	2.4 up to 7.5	9.0 up to 12.1	



rail | power FNC VA

Advanced FNC® line of products with internal recombination, extended service cycles



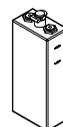
Performance H rail | power FNC VA H 2

Performance X rail | power FNC VA X 2

Dimensions L [mm]	39 up to 115	39 up to 115
W [mm]	122	122
H [mm]	309	309
Capacity [Ah]	38 up to 190	32 up to 170
Weight [kg]	2.6 up to 8.1	3.15 up to 8.9

rail | power FNC VC

Compact FNC® line of products with energy density for use where space is restricted

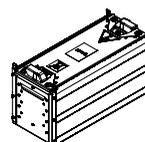


Performance M rail | power FNC VC M 2

Dimensions L [mm]	47 up to 115
W [mm]	122
H [mm]	309
Capacity [Ah]	80 up to 220
Weight [kg]	3.4 up to 8.2

rail | power LiOn 133 V

Standard basic modules specifically for applications with high system voltages



rail | power LiOn 133 VX

Dimensions L [mm]	570
W [mm]	250
H [mm]	300
Capacity [Ah]	42
Weight [kg]	55



Unique electrical design
Define your requirements - We create your battery!

Unique mechanical design
Designed for maintenance - Designed to cost!

HOPPECKE – Your specialist and partner for sustainable energy solutions!

Battery expert
Since 1927

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