

FNC®

Battery systems for stationary applications



Motive Power Systems

Reserve Power Systems

Special Power Systems

Service

Your advantages with HOPPECKE FNC®

- **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** - best properties under extreme temperature conditions
- **Low follow-up costs** - due to long maintenance intervals

Typical areas of application

- Power plants and transformer plants
- Emergency power supply
- Telecommunication systems
- Off-line power supply and with renewable energies
- Signal and control systems
- Starting emergency power units



HOPPECKE

POWER FROM INNOVATION

Unique, world-wide

The HOPPECKE FNC® technology. At advantage in heat and cold!

In 1983, HOPPECKE presented a nickel-cadmium battery, which to date is unique: the fibre structure technology, in short FNC®-Technology. The dense three-dimensional woven structure is extremely porous. Through this 90% of the volume of the fibre electrodes can be filled with the active material. This metallised polypropylene woven fibre structure was originally designed for such demanding applications as aviation and aerospace as well as electric and hybrid vehicles. The key features, when compared to other technologies:

- Discharge and charge allow high to very high currents
- It requires only a small nominal capacity for high currents
- Simultaneously, the volume and weight savings are significant

Reduce your costs by using the FNC® Technology!

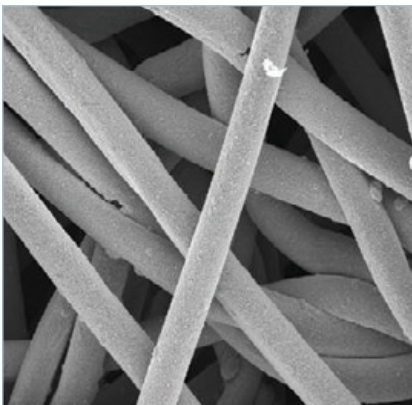
The FNC® fibre structure electrodes have a conductive nickel matrix. It is filled with the active material using

a specially developed process. No additives such as graphite or iron are used. Throughout the entire operating-life of the batteries, there is neither oxidation of graphite nor the formation of carbonate in the electrolytes. The consequence: The electrodes do not age. In contrary to conventional nickel-cadmium batteries, electrolyte replacement throughout the entire operating-life of the batteries is not necessary.

THE FNC® ADVANTAGES AT A GLANCE

- Advanced battery technology for high demands
- Long service life and life-cycles, even under extreme temperature conditions
- Wide product range in the area of high energy density or of high power density for optimal adjustment of the battery to the customers' needs
- Fulfils the highest demands for shock and vibration resistance

The FNC® cells can be operated reliably in a temperature range from -20 to +50 °C. Using a special electrolyte, temperatures of even -50 °C to +70 °C are possible.



The fibre structure: light, flexible and can be filled with up to 90% active material



The FNC® Technology has proven itself in the most extreme temperature

Maximum safety and durability

HOPPECKE FNC® -Cells are all purpose!

Whenever maximum battery capacity is required, the fibre structure nickel-cadmium technology (FNC®) is the optimal solution. Their electrochemical advantages ensure uninterrupted, safe operation: without the danger of a complete power failure or the risk of sudden battery failure. With the highest security for all applications, when the reliable operation of a system is essential.



FOUR FNC® BATTERY TYPES: FOR YOUR INDIVIDUAL APPLICATION

HOPPECKE has four FNC® battery types with different output curves to offer you. They cover all applications:

X-TYPES

X-types have ultra-thin plates. They provide a very high short-term output.

Typical applications: starting of engines and UPS systems.

H-TYPES

H-types are specialised for applications with discharge times of 30 minutes and higher required capacity.

Typical applications: starting of engines, UPS systems and switchboards.

M-TYPES

M-types are designed for varying load requirements or mixed loads for discharge times from 30 minutes to 2 hours.

Typical applications: emergency power supplies and switchboards.

L-TYPES

L-types are designed for general discharge characteristic curves with varying requirements, or for mixed loads. Discharge with high and low current density.

Typical applications: emergency power supplies, switchboards and energy storage.

All applications at a glance	X-Types	H-Types	M-Types	L-Types
Starting of engines	X	X		
UPS	X	X	X	X
Switchboards		X	X	X
Emergency power supply			X	X
Energy storage				X

X = Standard application

Security in every detail

The high-quality parts and components

ELECTRODES

The positive and negative electrodes of the FNC® batteries consist of a nickel fibre structure with graphite-free-active material. The special feature of the three-dimensional matrix, made from a nickel/fibre composite material, is its high elasticity: mechanical stresses and volume changes during charging/discharging are entirely absorbed by the electrodes.

SEPARATORS

The positive electrodes are covered by microporous separators. They separate the electrodes properly from each other and warrant a low internal resistance, which corresponds to the given operational demand levels.

ELECTROLYTE

The electrolyte is made from diluted potassium hydroxide with a density of 1.19 kg/l at 20 °C. HOPPECKE delivers the cells filled and charged. When delivered by sea or air freight, the empty discharged condition is recommended. In this case, the electrolyte is packed separately and ready to fill or in the form of a dry electrolyte.

CONTAINER

The battery container is made of robust, transparent polypropylene (PP), which facilitates the checking of the electrolyte levels. Other types of material are also possible. The containers and lids are welded together, ensuring that no gas or electrolyte can leak out. Special o-rings ensure good sealing at the terminal feedthroughs.

VENT PLUG

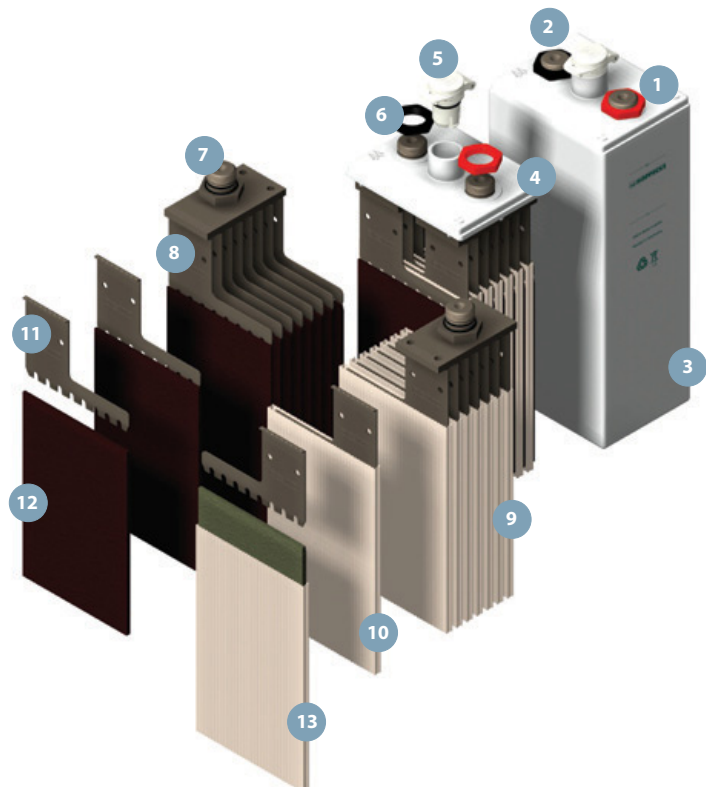
The flip top vent plugs and ignition protection make it easy to refill the cell. Furthermore, they protect the battery from external ignition.

CONNECTORS

The connectors are made of nickel-plated copper with extremely low resistance. For fitting they are simply screwed onto the cells. Insulated connectors are provided on request.

DESIGN OF THE FNC® CELL

- 1 Positive terminal
- 2 Negative terminal
- 3 Cell box
- 4 Cell over
- 5 Plug
- 6 Terminal nut
- 7 Cell terminal
- 8 Negative electrode packet
- 9 Positive electrode packet
- 10 Positive fibre structure electrode with separator
- 11 Lug
- 12 Negative fibre structure electrode
- 13 Separator



Advantages that pay off

- world-wide!

SERVICE LIFE OF UP TO 25 YEARS

In contrast to a lead acid battery, the electrolyte does not corrode the fibre structure plate. Therefore, when compared with other battery systems, the aging at higher temperatures is significantly reduced, resulting in lower costs during the life span of the system.

MINIMUM MAINTENANCE REQUIRED AND CAPABLE OF HIGH CURRENTS

The FNC® electrode structure has an active fibre length of more than 300 m³ per cm and a free volume of 90% for the active material. The advantages: lower internal resistance, longer service intervals, high current load - and the possibility to use lower capacities in comparison with other systems.

LOWER OPERATING COSTS

The graphite-free FNC® electrodes consist of pure active material without additives. During the entire service life of the battery, therefore, no change of the electrolyte is necessary. This significantly reduces the operating costs and protects the environment.

HIGH CYCLE LIFE

The high elasticity of the conductive material not only ensures a long service life, but also an excellent cycle life (over 3000 cycles under EN).

TOUGH TO EXTERNAL INFLUENCES

A big advantage is its excellent resistance against electrical and mechanical abuse.

WIDE OPERATING TEMPERATURE RANGE

HOPPECKE FNC®-Cells can be operated reliably in a temperature range from -20 °C to +50 °C. Using a special electrolyte, temperatures of even -50 °C to +70 °C are possible.

EASY MAINTENANCE IN STATIONARY APPLICATIONS

In addition to the vent plugs with snap closure, the transparent polypropylene containers also make servicing easier for stationary use: they allow an easy check of the electrolyte level.



FNC® stationary battery system

NO SUDDEN FAILURE

The decrease in capacity towards the end of service life is slow and gradual, without the danger of sudden failure of the battery.

LONG SHELF-LIFE

Unlimited shelf-life without loss of performance after putting into service.

HOPPECKE OFFERS A WORLDWIDE SERVICE

As a globally active supplier and manufacturer of system solutions for stationary applications, we place particular emphasis on excellent customer service. Not only in Germany, but in all the countries where we have subsidiaries: including the USA, China, Japan, Great Britain, the Netherlands, Belgium, France, Spain, Italy and Poland. Whether lead or NiCd batteries, whether our own systems or products from other manufacturers: our professionals take over the cleaning, repairs, refurbishments and the capacity tests including the full documentation.

OUR CONTRIBUTION TO ENVIRONMENTAL PROTECTION: OUR OWN RECYCLING CONCEPT

HOPPECKE Battery Systems make a contribution in accordance with the EU guidelines for responsible handling of industrial batteries by meeting the recycling quota. We guarantee our customers that they can return spent nickel-cadmium batteries - regardless of the technology, the manufacturer or age of the batteries. For this we have developed and implemented our own recycling concept.

Operational and technical characteristics

of FNC® batteries

Operating instructions

- Operating temperature range -50 °C to +60 °C
- Floating charge: 1.40 to 1.45 V/cell
- Boost charge: 1.50 to 1.70 V/cell
- Recharge time to 90% of the available capacity: 7-8 hours at normal boost charge
- Typical recharge current 0.1xC5A to 0.4xC5A (Higher charge currents of up to 10xC5A details available on request)
- Cell box and lid made of translucent polypropylene
- Box and lid seal: welded shut
- Terminal: nickel plated steel
- Electrode design: contact tab from nickel-plated steel welded to the fibre structure electrode
- Electrolyte: potassium hydroxide (density 1.19 kg/l at 20 °C)
- Load factor of 1.2
- Microporous separators
- Designed and tested in accordance with IEC 60623

Technical characteristics

NOMINAL CAPACITY

The nominal capacity of the nickel-cadmium battery is given in ampere-hours (Ah). It denotes the amount of electricity at +20°C, which can be removed from the battery after a full charge with a 5-hour discharge to 1.0 V /cell.

CELL VOLTAGE

The nominal voltage for nickel-cadmium batteries is 1.2 V, which corresponds to the average voltage during discharge at the rated current 0.2 C5A.

INTERNAL RESISTANCE AND SHORT CIRCUIT CURRENT

The internal resistance of a cell depends on the temperature and state of charge. It is calculated for standard applications from changes in the discharge voltage when the discharge current is changed. The short circuit current of a battery can be determined from the internal resistance.

The short circuit current of a fully charged FNC® battery is between the 10-fold (L-types) and the 45-fold (X-types) of the rated capacity in ampere.

AMBIENT TEMPERATURE AND OUTPUT

The ambient temperature affects the performance of a battery. The temperature therefore must be considered when designing a battery system. At low temperatures the available capacity is reduced. Charging at very high temperatures reduces the degree of charging efficiency.

SELF-DISCHARGE

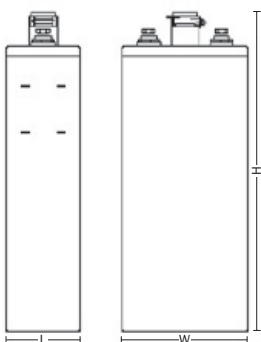
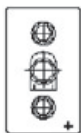
If stored without charging all the cells are subjected to a self-discharge, which rises sharply at high temperatures. During the first weeks the self-discharge is relatively high and slows down over the storage period. The typical self-discharge of FNC® batteries is shown in the diagram below.

FNC® cells available

Capacities, dimensions and weights

Performance L

Model	Capacity (Ah)	Dimensions (mm)			Weight of cell with electrolyte (kg)	Weight of cell without electrolyte (kg)	Filling capacity (l)
		Length	Width	Height			
FNC® 17 L	17	30	122	250	1.25	0.80	0.38
FNC® 35 L	35	39	122	250	1.70	1.25	0.38
FNC® 50 L	50	47	122	250	2.15	1.60	0.46
FNC® 70 L	70	58	122	250	2.60	1.95	0.55
FNC® 22 L	22	30	122	309	1.50	1.00	0.42
FNC® 45 L	45	47	122	309	2.50	1.50	0.84
FNC® 66 L	66	47	122	309	2.65	1.90	0.63
FNC® 90 L	90	72	122	309	3.85	2.45	1.18
FNC® 110 L	110	72	122	309	4.10	2.90	1.01
FNC® 132 L	132	92	122	309	5.15	3.30	1.55
FNC® 154 L	154	92	122	309	5.40	3.80	1.34
FNC® 176 L	176	115	122	309	6.40	4.30	1.76
FNC® 198 L	198	115	122	309	6.50	4.90	1.34
FNC® 222 L	222	92	194	309	8.50	5.85	2.23
FNC® 259 L	259	92	194	309	8.80	6.50	1.93
FNC® 296 L	296	115	194	309	10.60	7.30	2.77
FNC® 333 L	333	115	194	309	11.00	8.00	2.52
FNC® 370 L	370	115	194	309	11.10	8.50	2.18
FNC® 407 L	407	155	198	309	14.10	10.10	3.36
FNC® 444 L	444	155	198	309	14.50	10.80	3.11
FNC® 481 L	481	155	198	309	14.80	11.50	2.77
FNC® 518 L	518	155	198	309	15.20	12.10	2.61
FNC® 560 L	560	157	158	405	16.90	12.85	3.40
FNC® 605 L	605	202	209	405	24.2	15.7	7.50
FNC® 660 L	660	202	209	405	24.7	16.7	7.06
FNC® 715 L	715	202	209	405	25.2	17.6	6.71
FNC® 770 L	770	202	209	405	25.8	18.7	6.26
FNC® 825 L	825	202	209	405	26.3	19.6	5.91
FNC® 880 L	880	202	209	405	26.8	20.6	5.47
FNC® 935 L	935	238	209	405	30.5	22.0	7.50
FNC® 990 L	990	238	209	405	31.0	23.0	7.06
FNC® 1045 L	1045	238	209	405	31.5	24.0	6.62
FNC® 1100 L	1100	238	209	405	32.1	25.0	6.26



Technical changes reserved.

Performance M

Model	Capacity (Ah)	Dimensions (mm)			Weight of cell with electrolyte (kg)	Weight of cell without electrolyte (kg)	Filling capacity (l)
		Length	Width	Height			
FNC® 20 M	20	30	122	309	1.50	1.00	0.42
FNC® 40 M	40	47	122	309	2.60	1.60	0.84
FNC® 60 M	60	47	122	309	2.80	2.15	0.55
FNC® 80 M	80	72	122	309	3.95	2.70	1.05
FNC® 100 M	100	72	122	309	4.15	3.10	0.88
FNC® 120 M	120	92	122	309	5.35	3.65	1.43
FNC® 140 M	140	92	122	309	5.60	4.15	1.22
FNC® 160 M	160	115	122	309	6.65	4.75	1.60
FNC® 180 M	180	115	122	309	6.90	5.20	1.43
FNC® 200 M	200	92	194	309	8.70	6.25	2.06
FNC® 235 M	235	92	194	309	8.85	6.75	1.76
FNC® 265 M	265	115	194	309	10.50	8.00	2.10
FNC® 300 M	300	115	194	309	11.20	8.90	1.93
FNC® 340 M	340	157	158	405	15.05	9.60	4.58
FNC® 375 M	375	157	158	405	15.55	10.40	4.33
FNC® 415 M	415	157	158	405	16.05	11.20	4.08
FNC® 450 M	450	157	158	405	16.55	12.00	3.82

Performance H

Model	Capacity (Ah)	Dimensions (mm)			Weight of cell with electrolyte (kg)	Weight of cell without electrolyte (kg)	Filling capacity (l)
		Length	Width	Height			
FNC® 12 H	12	30	122	309	1.50	1.05	0.38
FNC® 23 H	23	30	122	309	1.60	1.25	0.29
FNC® 35 H	35	47	122	309	2.60	1.70	0.76
FNC® 46 H	46	47	122	309	2.80	2.00	0.67
FNC® 58 H	58	72	122	309	3.95	2.55	1.18
FNC® 69 H	69	72	122	309	4.15	2.85	1.09
FNC® 80 H	80	72	122	309	4.30	3.20	0.92
FNC® 93 H	93	92	122	309	5.40	3.70	1.43
FNC® 104 H	104	92	122	309	5.55	3.95	1.34
FNC® 115 H	115	115	122	309	6.60	4.45	1.81
FNC® 125 H	125	115	122	309	6.90	4.95	1.64
FNC® 135 H	135	115	122	309	7.05	5.25	1.51
FNC® 140 H	140	92	194	309	8.45	5.70	2.31
FNC® 160 H	160	92	194	309	8.75	6.25	2.10
FNC® 180 H	180	92	194	309	9.00	6.75	1.89
FNC® 200 H	200	115	194	309	10.85	7.50	2.82
FNC® 220 H	220	115	194	309	11.10	8.05	2.56
FNC® 240 H	240	115	194	309	11.45	8.55	2.44

Performance X

Model	Capacity (Ah)	Dimensions (mm)			Weight of cell with electrolyte (kg)	Weight of cell without electrolyte (kg)	Filling capacity (l)
		Length	Width	Height			
FNC® 14 X	14	30	122	250	1.40	1.10	0.25
FNC® 28 X	28	47	122	250	2.50	1.90	0.50
FNC® 47 X	47	72	122	250	3.70	2.90	0.67
FNC® 66 X	66	92	122	250	5.00	3.90	0.92
FNC® 85 X	85	115	122	250	6.20	4.80	1.18
FNC® 20 X	20	30	122	309	1.80	1.30	0.42
FNC® 39 X	39	47	122	309	2.95	2.20	0.63
FNC® 65 X	65	72	122	309	4.55	3.40	0.97
FNC® 91 X	91	92	122	309	6.00	4.60	1.18
FNC® 117 X	117	115	122	309	7.50	5.70	1.51
FNC® 130 X	130	92	194	309	9.00	6.40	2.18
FNC® 142 X	142	92	194	309	9.30	6.85	2.06
FNC® 153 X	153	92	194	309	9.55	7.30	1.89
FNC® 165 X	165	115	194	309	11.20	7.95	2.73
FNC® 177 X	177	115	194	309	11.50	8.40	2.61
FNC® 189 X	189	115	194	309	11.75	8.80	2.48
FNC® 200 X	200	115	194	309	12.10	9.30	2.35



Motive Power Systems



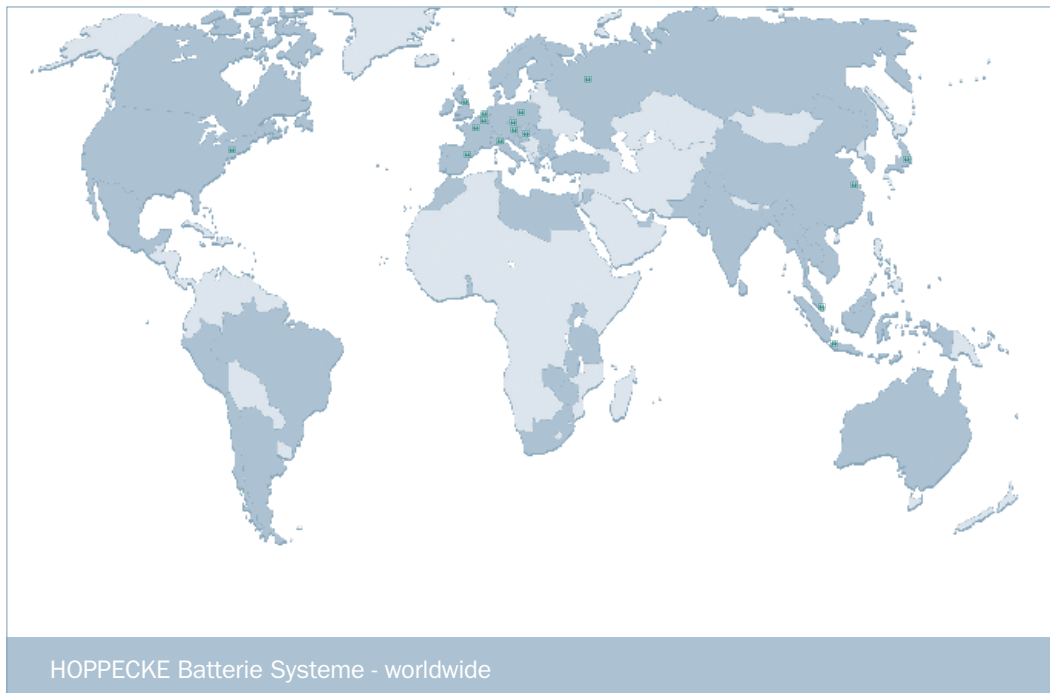
Reserve Power Systems



Special Power Systems



Service



HOPPECKE Batterie Systeme - worldwide

Industrial batteries - Complete energy systems - Full Service

- Low-maintenance and no-maintenance batteries
- Innovative battery chargers based on the latest technology
- Battery accessories
- Battery management systems and software
- Battery changeover systems
- Battery/charger servicing
- Battery recycling
- Applications engineering and technology
- Battery room design
- Technical training and seminars
- Leasing
- Energy sales

Your partner for sustainable energy

Further information visit: www.hoppecke.com

HOPPECKE Batterie Systeme GmbH

P.O. Box 1180 · D-59914 Brilon
An der Bremecke 4 · D-59929 Brilon

Phone: + 49 (0) 29 61 9706-212

Fax: + 49 (0) 29 61 9706-252

Email: hbs@hoppecke.com

Internet: www.hoppecke.com



Service hotline Germany:

0800 246 77 32

International service hotline:

+ 49 (0) 180 5 22 9999



POWER FROM INNOVATION