DNK POWER COMPANY LIMITED

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Material Safety Data Sheet

LITHIUM PHOSPHATE (LiFePO4) BATTERY

1. PRODUCT IDENTIFEICATION

LITHIUM PHOSPHATE (LiFePO4) Battery
Model: DNK-LFP26650
Nominal Voltage: 3.2V
Nominal Capacity: 3200mAh
Equivalent Lithium content: 10.24Wh
Testing Period: Jan 4, 2019 to Jan 28, 2019

2 Manufacturer

DNK POWER COMPANY LIMITED
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COMPOSITION.

With content of LITHIUM PHOSPHATE (LiFePO4) less than 100Wh per battery

Weight %	Component	CAS No.	PEL	TLV
40	Lithium Iron Phosphate ($LiFePO_4$)	15365-14-7	10.0 mg/m3 (as iron fume)	5.0 mg/m3
30	Graphite(C)	7440-44-0	2.5mg/m3(as dust)	2.0mg/m3(as dust)
10	Organic Electrolyte	N.A	None Established	None Established
5	Aluminium	7429-90-5	None Established	None Established
5	Copper	7440-50-8	None Established	None Established

Weight % listed is based on approximate percent of the average weight of the battery
Abbreviation：
CAS：Chemical Abstract Service
EC：European Inventory of Existing Commercial chemical Substances

3. HAZARD DATA

3.1 Physical:

The lithium iron phosphate (LiFePO4) battery described in this Material Safety Data Sheet are sealed which are not hazardous when used according to the recommendations of the manufacturer.

Under normal conditions of use, electrode materials and liquid electrolyte they contain are non-reactive provided the battery integrity is maintained and seals remain intact, Risk of exposure only in case of abuse, e.g. mechanical, thermal, electrical, which leads to the activation of safety valves and/or the rupture of the battery containers. Electrolyte leakage, electrode materials reaction with moisture/water of battery vent/explosion/fire may follow depending upon circumstances.

3.2 Chemical:

Classification of dangerous Substances Contained into the Product as per Directive

substance	Chemical Symbol	Content (%)	Melting Point℃	Indication of Danger	Special Risk	Safety Advice
lithium iron phosphate	LiFePO4	37~43	> 1000		R22 R43	S2 S22 S24 S26 S36 S37 S45
Carbon	C	28~32	> 1000			
Organic solvents	EC DMC DEC		EC : 38℃ DMC : 4℃ DEC : -43℃	Flammable	R21 R22 R41 R42/43	S2 S24 S26 S36 S37 S45
	LiPF6		N/A	Irritant Corrosive	R14	S2 S8 S22 S24 S26 S36

slight variations depending from all type

1. Name of Special Risks:

R14/15 Reacts with water and yields flammable gases
R21 Harmful in contact with skin
R22 Harmful us swallowed
R35 Causes severe burns
R41 Risk of serious damage to the eye
R42/43 May cause sensitization by inhalation and skin contact
R43 May cause sensitization by skin contact

2. Safety Advices:

S2 Keep out of reach from children
S8 Keep away from moisture
S22 Do not breathe dust
S24 Avoid contact with skin
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical attention
S36 Wear suitable protective clothing
S37 Wear suitable gloves
S45 In case of incident, seek medical attention

4. First Aid Measures

In case of battery rupture or explosion, evacuate personnel from contaminated area and provide maximum ventilation to clear out corrosive fumes/gases and pungent odors.

In all case, seek immediate medical attention,

Eye contact: Flush with plenty of water (eyelids-held open)for at least 15 minutes

Skin contact: Remove all contaminated clothing and flush affected areas with plenty of water and sop for at least 15minutes.

Ingestion: Dilute by giving plenty of water and get immediate medical attention.
Assure that the victim does not aspirate vomited material by use of positional Drainage.
Assure that mucus does not obstruct the airway.
Do not give anything by mouth to an unconscious person

Inhalation: Remove to fresh air and ventilate the contaminated area.
Give oxygen or artificial respiration if needed.

5. Fire-Fighting Measures

Fire and explosion hazard:	The batteries can leak and/or spout vaporized or decomposed and combustible electrolyte fumes in case of exposure above 90℃ resulting from inappropriate use or from the environment. Possible formation of hydrogen fluoride (HF) and phosphorous oxides during fire.LiPF6 salt contained in the electrolyte releases hydrogen fluoride (HF) in contact with water.
Extinguishing media:	Suitable : CO2, Dry chemical or Foam extinguishers Not to be used : Type D extinguishers
Special exposure hazards:	Following battery overheating due to external source or due to improper use, electrolyte leakage or battery container rupture may occur and release inner component/material in the environment. Eye contact: The electrolyte solution contained in the battery is irritant to ocular tissues. Skin contact: The electrolyte solution contained in the battery causes skin irritation. Ingestion: The ingestion of electrolyte solution causes tissue damage to throat and gastro/respiratory tract. Inhalation: Contents of a leaking or ruptured battery can cause respiratory tract, mucus, membrane irritation and edema.
Special protective equipment:	Use self-contained breathing apparatus to avoid breathing irritant fumes. Wear protective clothing and equipment to prevent body contact with electrolyte solution.

6. Accidental Release Measures

The material contained within the batteries would only be expelled under abusive conditions. Using shovel or broom, cover battery or spilled substances with dry sand or vermiculite, place in approved container (after cooling if necessary) and dispose in accordance with local regulations.

7. Handling and Storage

The batteries should not be opened destroyed or incinerated since they may leak or rupture and release in the environment the ingredients they contain.

Handling	Do not crush, pierce, short (+) and (-) battery terminals with conductive (i.e. metal) goods. not directly heat or solder. Do not throw into fire. Do not mix batteries of different types and nds. Do not mix new and used batteries. Keep batteries in non-conductive (i.e. plastic) trays.
Storage	Store in a cool (preferably below 30℃) and ventilated area away from moisture, sources of heat, open flames, food and drink. Keep adequate clearance between walls and batteries. Temperature above 90℃ may result in battery leakage and rupture. Since short circuit can cause burn, leakage and rupture hazard, keep batteries in original packaging until use and do not jumble them.
Other	manufacturer recommendations regarding maximum recommended currents and operating temperature range. Applying pressure on deforming the battery may lead to disassemble followed by eye, skin

	and throat irritation.

8. Exposure Controls/personal Protection

Respiratory protection:	Not necessary under normal use. In case of battery rupture, use self-contained full-face respiratory equipment. Equip with type ABEK filter.
Hand protection:	Not necessary under normal use. Use rubber gloves if handling a leaking or ruptured battery.
Eye protection:	Not necessary under normal use. Wear safety goggles or glasses with side shields if handling a leaking or ruptured battery.
Skin protection:	Not necessary under normal use. Use rubber apron and protective working in case of handling of a ruptured battery.

9. physical And Chemical Properties

9.1 Appearance (Physical shape and color as supplied:)

Metal squares, hermetically sealed and fitted with an external plastic box.

9.2 Temperature range

	Temperature range
In storage	+30℃max
During discharge	-25～+80℃

9.3 specific energy:135Wh/Kg

9.4 Specific pulse power: ≈ 300 Wh/kg

9.5 Mechanical resistance: As defined in relevant IEC standard

10. Stability and Reactivity

Conditions to avoid	Heat above 90℃ or incinerate. Deform, mutilate, crush, pierce, disassemble. Short circuit. Prolonged exposure to humid conditions.
Materials to avoid	N/A
Hazardous decomposition products	Corrosive/Irritant Hydrogen fluoride (HF) is produced in case of reaction of lithium (LiPF6) with water. Combustible vapors and formation of Hydrogen fluoride (HF) and phosphorous oxides during fire.

11. Toxicological Information

Inhalation, skin contact and eye contact are possible when the battery is opened.

Exposure to internal contents, the corrosive fumes will be very irritating to skin, eyes and mucous membranes.

Overexposure can cause symptoms of non-fibrotic lung injury and membrane irritation.

12 Ecological Information

Lithium-ion batteries do not contain heavy metals as defined by the European directives 2006/66/EC Article 21.

Mercury has not been “intentionally introduced (as distinguished from mercury that may be incidentally present in other materials)” in the sense of the U.S.A. “Mercury-Containing and Rechargeable Battery Management Act’’ (May 13 1996).

The Regulation on Mercury Content Limitation for Batteries promulgated on 1997-12-31 by the China authorities including the State Administration of Light Industry and the State Environmental Protection Administration defines ‘low mercury’ as ‘mercury content by weight in battery as less than 0.025%’, and ‘mercury free’ as ‘mercury content by weight in battery as less than 0.0001%’. And therefore: Icon Energy System lithium-ion batteries belong to the category of mercury-free battery (mercury content lower than 0.0001%).
When promptly used or disposed the battery does not present environmental hazard. When disposed, keep away from water, rain and snow.

13. Disposal Considerations

Dispose in accordance with applicable regulations which vary from country to country.

USA: Lithium-ion batteries are classified by the federal government as non-hazardous waste and are safe for disposal in the normal municipal waste stream. These batteries, however, do contain recyclable materials and are accepted for recycling by the Rechargeable Battery Recycling Corporation's (RPBC) Battery Recycling Program. Please go to the RPRC website at www.rbrc.org for additional information.

In the European Union, manufacturing, handling and disposal of batteries is regulated on the basis of the DIRECTIVE 2006/66/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC. Customers find detailed information on disposal in their specific countries using the web site of the European Portable Batteries Association (http://www.epbaeurope.net/legislation_national.html).
Importers and users outside EU should consider the local law and rules.

Lithium-Ion batteries should have their terminals insulated and be preferably wrapped in plastic bags prior to disposal.
In order to avoid short circuit and heating, used lithium-ion batteries should never be stored or transported in bulk. Proper measures against short circuit are:

A Storage of batteries in original packaging
B Coverage of the terminals
C Embedding in dry sand

14. Regulatory Information

Marking consideration: European Union: According to Directive 2006/66/EC, the batteries have to be marked with the crossed wheel bin symbol.
Lithium-ion batteries, which contain electronic modules (e.g. PCM) and which are subjected to the EMC directive 93/97/EEC, must be CE approved and must wear the CE marking.
According to Dangerous Goods Regulations (see 15.) battery packs have to be marked with the Watt-hour rating.
International safety standards: The basis cells are approved according to UL 1642
Water hazard class: (according to German Federal Water Management Act)
Non-water pollution according to VwVwS Appendix 1 (No. 1443 and 766)

15. TRANSPORT INFORMATION

We hereby certify that the captioned lithium ion batteries are non-hazardous materials for air transportation in any nature

This report applies to by sea, by air and by land;

The Li-ion Battery (model: DNK-LFP26650) tested according to the requirements of the 5th revised edition of the UN manual of tests and Criteria, Part Ⅲ, subsection 38.3;

Lithium-ion battery was protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to short circuit;

The Lithium-ion Battery according to Section IA of Packing Instruction 965 or Section I of Packing Instruction 966-967 of the 2018 IATA Dangerous Goods regulations 59th Edition may be transported and applicable U.S.DOT regulations for the safe transport of Li-ion Battery.

More information concerning shipping, testing, marking and packaging can be obtained from label master at http://www.labelmaster.com/.

The packaging shall be adequate to avoid mechanical damage during transport, handling and stacking. The materials and pack design shall be chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of moisture.

The package must be handled with care and that a flammability hazard exists if the package is damaged;
Each package must be labeled with a Li-ion Battery handling label or in addition to the Class 9 hazard label.
With regard to transport, the following regulations are cited and considered:

- The International Civil Aviation Organization (ICAO) Technical Instructions.
- The International Air transport Association (IATA) Dangerous Goods Regulations.

UN number of lithium-ion battery: UN3480 or UN3481;
UN Proper shipping name/Description (technical name): Lithium-ion batteries or Lithium-ion batteries contained in equipment or Lithium-ion batteries packed with equipment;
UN Classification (Transport hazard class): Dangerous;
Marine pollutant (Y/N): N;

- The International Maritime Dangerous Goods (IMDG) Code.

For lithium-ion batteries by sea, provided that packaging is strong and prevent the products from short-circuit.
UN number of lithium-ion battery: UN3480 or UN3481;
UN Proper shipping name/Description (technical name): Lithium-ion batteries or Lithium-ion batteries contained in equipment or Lithium-ion batteries packed with equipment;
UN Classification (Transport hazard class): Dangerous;
Marine pollutant (Y/N): Y;
Special Provision: International maritime dangerous goods code (IMDG) 188, 230, 310, 348, 957;

- The US Hazardous Materials Regulation (HMR) pursuant to a final rule issued by RSPA
- The Office of Hazardous Materials Safety within the US Department of Transportations' (DOT) Research

16. Other Information/Disclaimer

This information has been compiled from sources considered to be dependable and is, to the best of our

knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty (either expressed or implied) or guarantee is made to the accuracy, reliability or completeness of the information contained herein.

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