Safety Data Sheet

(UN GHS Format Compliant)

Section 1 - Identification of the Substance/Preparation and of the Company/Undertaking

Product Name: High Power/Energy Lithium Ion Battery Cells, Phosphate Based

Product Codes:
LFP123A
LFP18650E
LFP26650EV
LFP18650P
LFP26650P

Product Use: Energy Storage; Battery Cell and Battery Packs

Chemical Family: N/A

Synonyms: LFP Battery, Lithium Iron Phosphate Battery

Manufacturer:
K2 Energy Solutions
7461 Eastgate Road
Henderson, NV 89011

Phone Number: 702-478-3590
Fax: 702-558-0180
24-Hour Emergency: Chemtrec: 800-424-9300

Section 2 - Hazards Identification

Protective Clothing	NFPA Rating (USA)	EC Classification	GHS Hazard Symbol
Not Required with Normal Use		Not Classified as Hazardous	 Warning

Preparation Hazards and Classification: Not dangerous with normal use. The materials within the battery may only represent a hazard if the structural integrity of the battery is compromised. Do not expose the batteries to fire or open flame. Do not mix batteries of varying sizes, chemistries, or types. Do not short circuit, puncture, incinerate, crush, over-charge, over discharge, or expose the batteries to temperatures above or below the declared limit. Damage to the batteries may result in the risk of fire or explosion, which could release dangerous hydrogen fluoride gas and exposure to the ingredients contained within or their combustion products could be harmful.

Appearance, Color, and Odor: Solid object, no odor.

Primary Route(s) of Exposure: Risk of exposure will only occur if the battery cell is mechanically, thermally, or

electrically damaged and the enclosure is compromised. If this occurs, exposure to electrolyte solutions contained within the battery cell may occur by inhalation, eye contact, skin contact and ingestion.

Potential Health Effects: Acute (Short Term): see Section 8 for Exposure Controls and Personal Protection. In the event of disassembly or rupture, the electrolyte contained in the cell is corrosive and may cause burns to skin and eyes.

Inhalation: Inhalation of material from a sealed battery is not an expected route of exposure. Vapors or mists from a ruptured battery may cause respiratory irritation.

Ingestion: Swallowing of material from a sealed battery is not an expected route of exposure. Swallowing mists from a ruptured battery may cause respiratory irritation, chemical burns of the mouth and gastrointestinal tract irritation.

Skin: Contact between the battery and skin will not cause any harm. Skin contact with positive and negative terminals of high voltages may cause burns to the skin. Skin contact with a ruptured battery can cause skin irritation.

Eye: Eye contact with the contents of a ruptured battery can cause severe irritation to the eye.

Medical Conditions Aggravated by Exposure: Medical conditions related to potential exposure modalities may be exacerbated by exposure to the materials.

Section 3 - Composition/Information on Ingredients

As manufactured and under normal use, this battery is not expected to expose user to hazardous ingredients.

USA: This item is an article pursuant to 29 CFR 1910.1200 and, as such, is not subject to the OSHA Hazard Communication Standard requirement. The information contained in this Safety Data Sheet contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.

Canada: This is not a controlled product under WHMIS. This product meets the definition of a “manufactured article” and is not subject to the regulations of the Hazardous Products Act.

European Communities (EC): This product is not classified as hazardous according to Regulation (EC) No. 1272/2008. This product contains dangerous ingredients however, there is no expected release during use of the product and there is a barrier preventing exposure of the user and the environment.

Common Chemical Name	CAS #	Percent of Content (%)	Classification and Hazard Labeling
Lithium Iron Phosphate (LiFePO4)	15365-14-7	25-35	Eye, Skin, Respiratory Irritant
Carbon, as Graphite	7440-44-0	12-18	Eye, Skin, Respiratory Irritant
Aluminum Metal	7429-90-5	3-7	Inert
Copper Metal	7440-50-8	5-9	Inert
Electrolyte:			Mixture: Flammable; Reactive; Sensitizer; Eye, Skin & Respiratory Irritant
Ethylene carbonate	96-49-1	3-5	
Dimethyl carbonate	616-38-6	3-5	
Ethyl methyl carbonate	623-53-0	3-5	
Lithium Hexafluorophosphate	21324-40-3	1-3	
Polypropylene	9003-07-0	2-3	Inert
Mild steel can & cap	Not applicable	18-22	Inert

Section 4 – First Aid Measures

Skin Contact: Contact with internal contents may cause burns. If skin contact with internal contents occurs, remove affected articles of clothing. Wash affected area with lukewarm water for at least 30 minutes. If irritation or pain persists, seek medical attention. Decontaminate affected articles of clothing before reuse or discard.

Eye Contact: Contact with internal contents may cause burns. If eye contact with internal contents occurs, wash out affected eye with gentle flowing lukewarm water while holding eyelids open for at least 30 minutes. Rinse with neutral saline solution if possible. Use caution not to rinse contaminated water into the unaffected eye, nose, mouth, or onto the face. Seek medical attention.

Inhalation: If internal contents are inhaled, move victim to fresh air and remove source of contamination from area. Seek medical advice.

Ingestion: If ingestion of internal contents occurs, rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration and continue to rinse mouth with water. Seek medical attention immediately.

Caution: In all cases evacuate the contaminated area. If irritation persists, seek medical assistance at once.

Section 5 - Fire Fighting Measures

NFPA:

Health:	0
Flammability:	1
Instability:	0

Suitable Extinguishing Media: Water, carbon dioxide, dry chemical powder and foam are most effective means to extinguish a battery fire

Unsuitable Extinguishing Media: Not Applicable

Fire Fighting Procedure: Wear fully protective gear, including self-contained positive pressure breathing apparatus, goggles, fireproofing jacket and gloves. Caution is advised during application of water because burning particles may be ejected from the fire.

Unusual Fire and Explosion Hazards: Exposing battery cell to excessive heat, fire or over voltage condition may cause a leak, fire, hazardous vapors and hazardous decomposition products. Damaged or opened cells or batteries can result in rapid heating and the release of flammable vapors and potentially dangerous gases that may be heavier than air and could travel along the ground or be moved by ventilation to an ignition source.

Specific Hazards from the Chemical:	The interaction of water or water vapor and exposed lithium hexafluorophosphate (Li PF6) may result in the generation of hydrogen and hydrogen fluoride (HF) gas. Contact with battery electrolyte may be irritating to skin, eyes and mucous membranes. Fire will produce irritating, corrosive and/or toxic gases. Fumes may cause dizziness or suffocation.

Section 6 - Accidental Release Measures

Personal Precautions:	Hazardous material contained within the batteries cells will only be expelled if the battery is damaged or abused. If an accidental release occurs, personnel in the immediate vicinity should ensure containment measures and evacuation procedures are performed rapidly before any clean up. All non-required personnel for containment and clean up should observe the evacuation procedures.
Evacuation Procedures:	If an accidental release occurs, evacuate the area, except for required containment and clean up personnel. Maintain a minimum clearance of 25 meters (75 feet) in all directions. Stay upwind of the release, keep out of low areas, and ventilate closed areas before re-entering.
Environmental Precautions:	Prevent released material from contaminating soil or entering sewers or waterways by capping drains or placing up barriers.
Containment Procedures:	Stop the release if safe to do so. Contain any spilled liquid with dry sand, earth, or vermiculite. Move the damaged object to an isolated area, containment chamber, or cover with a fire proof containment blanket if safe to do so. Clean up spills immediately.
Clean Up Procedures:	Wear adequate personal protective equipment as indicated in Section 8. Absorb spilled liquid material with an inert absorbent (dry sand, earth, or vermiculite) material. Collect all debris and contaminated absorbent into an acceptable waste container and dispose of according to directions in Section 13. Scrub the spill area with detergent and water; collect all contaminated wash water for proper disposal.

Section 7 – Handling and Storage

Handling Precautions:	Do not expose battery or cell to extreme temperatures or fire. Do not disassemble, crush or puncture battery. Do not overcharge or over discharge the battery. Do not mix batteries of varying types or sizes. Do not connect (short circuit) positive and negative terminals or place the batteries on conductive metal.
Safe Storage Recommendations:	Insulate positive and negative terminals, when not in use, to avoid short circuit. Ensure sufficient clearance between batteries and other surfaces. Store in a dry,

cool (25°C +/-5°C, 10-50% RH) and well-ventilated area. Elevated temperatures can result in reduced battery life and venting of flammable liquid and gases. Keep batteries away from strong oxidizers and acids. Keep out of reach of children.

Section 8 – Exposure Controls and Personal Protection

Personal Protection:

Respiratory Protection: Not necessary under normal use. In case of battery or cell rupture, use a self-contained full face respiratory mask.

Skin Protection: Not necessary under normal use. Wear rubber apron and Viton rubber gloves if handling a ruptured or leaking battery cell.

Eye Protection: Not necessary under normal use. Wear safety goggles if handling a ruptured or leaking battery cell.

Engineering Controls: Use local exhaust ventilation or other engineering controls to control sources of dust, mist, fume and vapor.

Exposure Limits: Exposures to hazardous substances are not expected when product is used for its intended purpose. In the event of rupture or disassembly the following exposure limits apply.

Common Chemical Name/General Name	OSHA PEL-TWA	ACGIH (2010) TLV-TWA
Lithium Iron Phosphate	10.0 mg/m3 (as iron fume)	5.0 mg/m3 (as iron fume)
Electrolyte	Not Established	Not Established
Carbon, As Graphite	5.0 mg/m3 (respirable fraction)	2.0 mg/m3 (respirable fraction)

Notes:
OSHA: Occupational Safety and Health Administration
PEL-TWA: Permissible Exposure Limits-Time Weighted Average Concentration
ACGIH: American Council of Government Industrial Hygienists
TLV-TWA: Threshold Limit Value-Time Weighted Average Concentration

Section 9 – Physical and Chemical Properties

Appearance:	Cell Battery	Physical State:	Solid
Color:	Not Applicable	pH:	Not Applicable
Odor Type:	Odorless	Odor Threshold:	Not Applicable
Melting Point:	Not Applicable	Freezing Point:	Not Applicable
Boiling Point:	Not Applicable	Boiling Range:	Not Applicable
Flash Point and Method (C°):	Not Applicable	Evaporative Rate: (n-Butyl Acetate = 1)	Not Applicable
Flammability:	Not Applicable	Flammability/Explosive Limits (%):	Not Applicable
Oxidizing Properties:	Not Applicable	Viscosity:	Not Applicable
Relative Density:	Not Applicable	Auto Ignition Temperature (C°):	Not Applicable
Solubility in Water:	Insoluble	Vapor Pressure: (mm Hg @ 20 C°)	Not Applicable
Water/ Oil Distribution Coefficient:	Not Applicable	Vapor Density: (Air = 1)	Not Applicable
Decomposition Temperature:	Not Applicable		

Section 10 – Stability and Reactivity

Reactivity: Not Available

Chemical Stability: Stable under normal use.

Other:

Possibility of Hazardous Reactions: Hydrogen fluoride gas may be produced in reaction with water.

Conditions to Avoid: Avoid exposing battery to high temperatures. Do not incinerate, deform, mutilate, crush, pierce, short circuit or disassemble.

Incompatible Materials: Not Applicable

Hazardous Decomposition Products: Combustible vapors may be released if exposed to fire.

Section 11 – Toxicological Information

Short and Long Term Exposure Effect Information:

Inhalation: Toxicity data and effects of inhalation exposure are not available. Not a likely route of exposure under normal use.

Ingestion: Toxicity data and effects of ingestion exposure are not available. Not a likely route of exposure under normal use.

Skin Contact: Toxicity data and effects of skin contact exposure are not available. Not a likely route of exposure under normal use.

Eye Contact: Toxicity data and effects of eye contact exposure are not available. Not a likely route of exposure under normal use.

Other Toxicity and Effect Information:

Irritation: Risk of irritation only occurs if battery cells are mechanically, thermally or electrically damaged and the enclosure is compromised. If this occurs, irritation to the skin, eyes, and respiratory tract may occur.

Neurological Effects: No information is available at this time.

Sensitization: The nervous system and organs may be sensitized by exposure to a damaged or compromised battery cell enclosure.

Teratogenicity: No information is available at this time.

Reproductive Toxicity: No information is available at this time.

Mutagenicity (Genetic Effects): No information is available at this time.

Toxicologically Synergistic Materials: No information is available at this time.

Carcinogenicity: Normal use will not result in exposure to substances that are considered human carcinogens by IARC (International Agency for Research on Cancer), ACGIH (American Conference of Governmental Industrial Hygienists), OSHA or NTP (National Toxicology Program).

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Section 12 – Ecological Information

Bioaccumulative potential: Not available.

Persistence and degradability: Not available.

Mobility: Not available.

Ecotoxicity: Not available.

Other Adverse Effects: Not available.

Section 13 – Disposal Considerations

Waste Disposal Method: Recycling is encouraged. Do NOT dump into sewage or water bodies. Dispose of in accordance with local, state and federal laws and regulations.

Special Precautions: Discharge batteries fully and cap terminals before disposal. Handle according to Section 7 and Section 8 to minimize exposure.

Regional Regulations:

USA: Dispose of in accordance with local, state and federal laws and regulations.

Canada: Dispose of in accordance with local, state and federal laws and regulations.

EC: Dispose of in accordance with relevant EC Directives and national, regional, or local regulations. Use appropriate code from European Waste Catalogue (EWC) for disposal within the EC,

Other: Dispose of in accordance with local, state and federal laws and regulations.

Section 14 – Transport Information

K2 Energy Cells listed in Section 1 are designed to comply with standard international shipping regulations including the UN Recommendations on the Transport of Dangerous Good; the IATA Dangerous Goods Regulations; the International Maritime Dangerous Goods Code; and the US DOT Regulations for the safe transportation of lithium batteries. As required by the regulation directives, the cells have passed the UN Manual of Test and Criteria Part III, Subsection 38.3.

ICAO Classification: (International Civil Aviation Organization)

UN Number: UN3480

UN Proper Shipping Name: LITHIUM ION BATTERIES

Transport Hazard Class: Class 9

Packing Group Number: Packing Group II

Notes and Exceptions: Packaging, markings, and documentation requirements are defined in the International Air Transport Association (IATA) Dangerous Goods Regulations

(DGR) Packing Instructions 965.
In some cases, excepted cells and batteries are allowed to be transported internationally without Class 9 packaging and in some circumstances markings, but must conform to other requirements as stipulated in Packing Instructions 965 of the IATA DGR.

IMDG Classification: (International Maritime Dangerous Goods)

UN Number: UN3480

UN Proper Shipping Name: LITHIUM ION BATTERIES

Transport Hazard Class: Class 9

Packing Group Number: Packing Group II

Notes and Exceptions: Packaging, markings, and documentation requirements are defined in the IMDG code Packing Instructions P903.
In some cases, excepted cells and batteries are allowed to be transported internationally without Class 9 packaging and in some circumstances markings, but must conform to Special Provision 188 under the IMDG code.

U.S. HMR Classification: (United States Hazardous Materials Regulations)

UN Number: UN3090

UN Proper Shipping Name: LITHIUM BATTERY

Transport Hazard Class: Class 9

Packing Group Number: Packing Group II

Notes and Exceptions: Packaging, markings, and documentation requirements are defined in Title 49 of the Code of Federal Regulations (CFR), Section 173.185. of the U.S. HMR.
In some cases, excepted cells and batteries are allowed to be transported within the US without Class 9 packaging and markings, but must conform to other requirements as stipulated in Special Provisions 188 and 189 in the 49 CFR Section 173.185 of the U.S. HMR.

Section 15 – Regulatory Information

USA

OSHA HCS This SDS complies with requirements of the Hazard Communication Standard (HCS) 29 CFR 1910.1200(g) and Appendix D.

EPA TSCA Status: All ingredients in the product are listed on the TSCA inventory.

EPA SARA Title III:

Sec. 302/304: None

Sec. 311/312: None

Sec. 313: None

EPA CERCLA RQ: None

California Prop 65: This product does not contain chemicals known to the State of California to cause cancer or reproductive toxicity.

Canada This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all the information

required by the Controlled Products Regulations.

WHMIS Classification: Not Controlled

New Substance Notification Regulations: All ingredients in the product are listed, as required, on Canada's Domestic Substance List.

NPRI Substances: This product does not contain any NPRI chemicals.

EC

Classification / Symbol: This product is not classified as hazardous according to Regulation (EC) 1272/2008.

Risk Phrases: None

Safety Phrases: Keep out of the reach of children.

Section 16 – Other Information

Original Preparation Date: October 05, 2009

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Document Title: LFP Battery Cell SDS

Revision Summary: A : Released

Current Revision Date: July 31, 2013

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