



Lithium-ion Rechargeable Battery Pack

LG Chem, Ltd.

MSDS for HP Batteries.

- History

| Version. | Items | Description | Date |
|----------|--------|--|------------|
| V01 | Origin | Initial Release | 2014.08.01 |
| V02 | Add | Add HV02032XL, DB03036 | 2014.09.15 |
| V03 | Add | Add KI04041, KI04048 | 2014.10.14 |
| V04 | Add | Add HS03031, HS04041 | 2014.12.06 |
| V05 | Add | Update 2015 format Add CI03048XL | 2015.01.06 |
| V06 | Add | Add DO02033XL, AI06096XL, ZO04064XL, RI06055XL, RO06055XL | 2015.02.02 |
| V07 | Add | Update OA03031/OA04041 of C4 | 2015.02.04 |
| V08 | Add | Add MU06055 | 2015.02.13 |
| V09 | Add | Add HV03048XL | 2015.04.20 |
| V10 | Add | Update CA06055XL/VI04041 of C4 | 2015.07.23 |
| V11 | Add | Add PG03064XL/GI02033XL | 2015.08.05 |
| V12 | Add | Add Vail | 2015.08.13 |
| V13 | Add | Add MU06062 | 2015.10.13 |
| V14 | Add | Add BP02041XL/SE03041XL | 2015.11.17 |
| V15 | Update | IATA regulation | 2016.01.08 |
| V16 | Add | Add SG03041XL/SG03061XL | 2016.01.11 |
| V17 | Add | Add VE06047 | 2016.02.17 |
| V18 | Add | Add MT03028/MT06055 | 2016.02.18 |
| V19 | Add | Add TA03051XL/ST03049XL | 2016.03.14 |
| V20 | Add | Add SW02032XL | 2016.03.18 |
| V21 | Add | Add DR02043XL | 2016.03.23 |
| V22 | Add | Add RR03048XL | 2016.04.08 |
| V23 | Add | Add SH03057XL | 2016.04.20 |
| V24 | Add | Add CN03057XL | 2016.05.12 |
| V25 | Add | Add OWK-INTERNAL and OWK-EXTERNAL | 2016.05.30 |

The Attached MSDS, accurately represents the chemical construction, of the HP Batteries listed below.

| No. | Model | HP Project P/N | Wh | Cell type |
|-----|------------|----------------|-----|---------------|
| 1 | CA06055 | HSTNN-LB4X | 55 | 18650 B4 |
| 2 | CA06055XL | HSTNN-LB4Y | 55 | 18650 C2 / C4 |
| 3 | CA09100 | HSTNN-LB4Z | 91 | 18650 D1 |
| 4 | CC06055 | HSTNN-LB2F | 55 | 18650 B4 |
| 5 | CC06055XL | HSTNN-LB2H | 55 | 18650 C2 |
| 6 | CC06062 | HSTNN-LB2G | 62 | 18650 C2 |
| 7 | CC09100 | HSTNN-LB2I | 100 | 18650 D1 |
| 8 | FP06047 | HSTNN-LB4J | 47 | 18650 S3 |
| 9 | FP09093 | HSTNN-LB4K | 93 | 18650 C2 |
| 10 | HY04041 | HSTNN-LB4U | 41 | 18650 C2 |
| 11 | MO09100 | HSTNN-LB3P | 100 | 18650 D1 |
| 12 | OA03031 | HSTNN-LB5Y | 31 | 18650 C2 / C4 |
| 13 | OA04041 | HSTNN-LB5S | 41 | 18650 C2 / C4 |
| 14 | PH06047 | HSTNN-LB1A | 47 | 18650 S3 |
| 15 | PI06047 | HSTNN-LB4N | 47 | 18650 S3 |
| 16 | PI06062 | HSTNN-LB4O | 62 | 18650 C2 |
| 17 | PR06047 | HSTNN-LB2R | 47 | 18650 S3 |
| 18 | PR08073 | HSTNN-LB2S | 73 | 18650 B4 |
| 19 | VH08075XL | HSTNN-LB2Q | 75 | 18650 C2 |
| 20 | VH08083 | HSTNN-LB2P | 83 | 18650 C2 |
| 21 | VI04041 | HSTNN-LB6I | 41 | 18650 C2 / C4 |
| 22 | VI04044 | HSTNN-LB6J | 44 | 18650 D1 |
| 23 | VI04048 | HSTNN-LB6K | 48 | 18650 E1 |
| 24 | AO02030XL | HSTNN-LB5O | 30 | ICP3674120L1 |
| 25 | A2304051XL | HSTNN-LB5R | 51 | ICP3768110L2 |
| 26 | CD02031 | HSTNH-L01B | 31 | ICP3473131L1 |
| 27 | CM03050XL | HSTNN-LB4R | 50 | ICP666180L1 |
| 28 | KT02025XL | HSTNN-LB6F | 25 | ICP3076120L1 |
| 29 | MA02025XL | HSTNN-LB5B | 25 | ICP3076120L1 |
| 30 | ME03037XL | HSTNN-LB6O | 37 | ICP485780A1 |
| 31 | MY02021XL | HSTNN-LB5C | 21 | ICP289791L1 |
| 32 | NP03043XL | HSTNN-LB6L | 43 | ICP606080L1 |

| | | | | |
|----|-----------------|------------|----|--------------|
| 33 | PE03036XL | HSTNN-LB6M | 36 | ICP485780A1 |
| 34 | PL02029XL | HSTNN-LB6B | 29 | ICP606080L1 |
| 35 | PX03050XL (Pol) | HSTNN-LB4P | 50 | ICP646480L1 |
| 36 | PX03050XL (Pri) | HSTNN-LB4P | 50 | ICP666180L1 |
| 37 | RG04051XL | HSTNN-LB5Q | 51 | ICP3768110L2 |
| 38 | RR04058 | HSTNN-LB6N | 58 | ICP606080L1 |
| 39 | SK02030XL | HSTNN-LB6G | 30 | ICP556790L1 |
| 40 | SB03046XL | HSTNN-LB4T | 46 | ICP556790L1 |
| 41 | HV02032XL | HSTNN-LB6P | 32 | ICP606080A2 |
| 42 | DB03036 | HSTNN-LB6Q | 36 | 18650 E1 |
| 43 | KI04041 | HSTNN-LB6R | 41 | 18650 C4 |
| 44 | KI04048 | HSTNN-LB6S | 48 | 18650 E1 |
| 45 | HS03031 | HSTNN-LB6U | 31 | 18650 C4 |
| 46 | HS04041 | HSTNN-LB6V | 41 | 18650 C4 |
| 47 | CI03048XL | HSTNN-LB6T | 48 | ICP606080A2 |
| 48 | DO02033XL | HSTNN-LB6Y | 33 | ICP3182113L1 |
| 49 | AI06096XL | HSTNN-LB6X | 96 | ICP606080A2 |
| 50 | ZO04064XL | HSTNN-LB6W | 64 | ICP606080A2 |
| 51 | RI06055XL | HSTNN-LB6Z | 55 | 18650 C4 |
| 52 | RO06055XL | HSTNN-LB7A | 55 | 18650 C4 |
| 53 | MU06055 | HSTNN-LB0X | 55 | 18650 B4 |
| 54 | HV03048XL | HSTNN-LB7B | 48 | ICP606080A2 |
| 55 | PG03064XL | HSTNN-LB7C | 64 | ICP3678122 |
| 56 | GI02033XL | HSTNN-LB7D | 33 | ICP3182113L1 |
| 57 | Vail | HSTNN-LB11 | 69 | ICR18650 A2 |
| 58 | MU06062 | HSTNN-LB0Y | 62 | ICR18650 C2 |
| 59 | BP02041XL | HSTNN-LB7H | 41 | ICP666180B1 |
| 60 | SE03041XL | HSTNN-LB7G | 41 | ICP496080L1 |
| 61 | SG03041XL | HSTNN-LB7E | 41 | ICP496080L1 |
| 62 | SG03061XL | HSTNN-LB7F | 61 | ICP666180B1 |
| 63 | VE06047 | HSTNN-LB42 | 47 | ICR18650S2 |
| 64 | MT03028 | HSTNN-LB3A | 28 | ICR18650B4 |
| 65 | MT06055 | HSTNN-LB3B | 55 | ICR18650B4 |
| 66 | TA03051XL | HSTNN-LB7J | 51 | ICP506480L1 |
| 67 | ST03049XL | HSTNN-LB7K | 49 | ICP505295L1 |
| 68 | SW02032XL | HSTNN-LB7N | 32 | ICP2982111L1 |

| | | | | |
|----|--------------|------------|----|--------------|
| 69 | DR02043XL | HSTNN-LB7M | 43 | ICP3678122L1 |
| 70 | RR03048XL | HSTNN-LB7I | 48 | ICP606080A2 |
| 71 | SH03057XL | HSTNN-LB7L | 57 | ICP368598 |
| 72 | CN03057XL | HSTNN-LB7L | 57 | ICP368598 |
| 73 | OWK-INTERNAL | | 93 | 18650 C4 |
| 74 | OWK-EXTERNAL | | 73 | 18650 HG2 |

MATERIAL SAFETY DATA SHEET

Lithium-Ion Battery

LG Chem, Ltd.

1. Chemical Product and Company Identification

Product Identification

Lithium-Ion Battery (All models manufactured by LG Chem, Ltd)

Manufacturer

LG Chem, Ltd.
 LG Twin Towers, 128, Yeoui-daero,
 Yeongdeungpo-gu, Seoul 150-721, Korea

Emergency Telephone Number

82-2-3773-7256

2. Composition Information

| Hazardous Ingredients | % | CAS Number |
|----------------------------------|------|------------|
| Aluminum Foil | 2-10 | 7429-90-5 |
| Nickel compound (proprietary) | 0-25 | |
| Manganese compound (proprietary) | 0-15 | |
| Cobalt compound (proprietary) | 4-50 | |
| Styrene-Butadiene-Rubber | <1 | |
| Polyvinylidene Fluoride (PVDF) | <5 | 24937-79-9 |
| Copper Foil | 2-10 | 7440-50-8 |

| | | |
|---|-----------|-----------|
| Carbon (proprietary) | 10-30 | 7440-44-0 |
| Electrolyte (proprietary) | 10-20 | |
| Stainless steel, Nickel and inert materials | Remainder | N/A |

Emergency Overview

May explode in a fire, which could release hydrogen fluoride gas.
Use extinguishing media suitable for materials burning in fire.

3. Hazards Identification

Primary routes of entry

| | | |
|-----------------|---|----|
| Skin contact | : | NO |
| Skin absorption | : | NO |
| Eye contact | : | NO |
| Inhalation | : | NO |
| Ingestion | : | NO |

Symptoms of exposure

Skin contact

No effect under routine handling and use.

Skin absorption

No effect under routine handling and use.

Eye contact

No effect under routine handling and use.

Inhalation

No effect under routine handling and use.

Reported as carcinogen

Not applicable

4. **First Aid Measures**

Inhalation

Not a health hazard.

Eye contact

Not a health hazard.

Skin contact

Not a health hazard.

Ingestion

If swallowed, obtain medical attention immediately.

IF EXPOSURE TO INTERNAL MATERIALS WITHIN CELL DUE TO DAMAGED OUTER CASING, THE FOLLOWING ACTIONS ARE RECOMMENDED ;

Inhalation

Leave area immediately and seek medical attention.

Eye contact

Rinse eyes with water for 15 minutes and seek medical attention.

Skin contact

Wash area thoroughly with soap and water and seek medical attention.

Ingestion

Drink milk/water and induce vomiting; seek medical attention.

5. Fire Fighting Measures

General Hazard

Cell is not flammable but internal organic material will burn if the cell is incinerated. Combustion products include, but are not limited to hydrogen fluoride, carbon monoxide and carbon dioxide.

Extinguishing Media

Use extinguishing media suitable for the materials that are burning.

Special Firefighting Instructions

If possible, remove cell(s) from fire fighting area. If heated above 125°C, cell(s) may explode/vent.

Firefighting Equipment

Use NIOSH/MSHA approved full-face self-contained breathing apparatus (SCBA) with full protective gear.

6. Accidental Release Measures

On Land

Place material into suitable containers and call local fire/police department.

In Water

If possible, remove from water and call local fire/police department.

7. Handling and Storage

Handling

No special protective clothing required for handling individual cells.

Storage

Store in a cool, dry place.

8. Exposure Controls / Personal Protection

Engineering controls

Keep away from heat and open flame. Store in a cool dry place.

Personal Protection

Respirator

Not required during normal operations. SCBA required in the event of a fire.

Eye/face protection

Not required beyond safety practices of employer.

Gloves

Not required for handling of cells.

Foot protection

Steel toed shoes recommended for large container handling.

9. Physical and Chemical Properties

| | |
|---------------------|-----------|
| State | Solid |
| Odor | N/A |
| PH | N/A |
| Vapor pressure | N/A |
| Vapor density | N/A |
| Boiling point | N/A |
| Solubility in water | Insoluble |
| Specific gravity | N/A |
| Density | N/A |

10. Stability and Reactivity

Reactivity

None

Incompatibilities

None during normal operation. Avoid exposure to heat, open flame, and corrosives.

Hazardous Decomposition Products

None during normal operating conditions. If cells are opened, hydrogen fluoride and carbon monoxide may be released.

Conditions To Avoid

Avoid exposure to heat and open flame. Do not puncture, crush or incinerate.

11. Toxicological Information

This product does not elicit toxicological properties during routine handling and use.

| Sensitization | Teratogenicity | Reproductive toxicity | Acute toxicity |
|---------------|----------------|-----------------------|----------------|
| NO | NO | NO | NO |

If the cells are opened through misuse or damage, discard immediately. Internal components of cell are irritants and sensitizers.

12. Ecological Information

Some materials within the cell are bioaccumulative. Under normal conditions, these materials are contained and pose no risk to persons or the surrounding environment.

13. Disposal Considerations

California regulated debris

RCRA Waste Code : Nonregulated

Dispose of according to all federal, state, and local regulations.

14. Transport Information

Lithium Ion batteries are considered to be "Rechargeable batteries" and meet the requirements of transportation by the U.S. Department of Transportation(DOT), the International Civil Aviation Administration(ICAO), the International Maritime Dangerous Goods (IMDG) Code.

Even classified as lithium ion batteries (UN3480), 2016 IATA Dangerous Goods Regulations 57th edition Packing Instruction 965 Section IB or II is applied.

The general and additional requirements apply to all lithium ion cells and batteries prepared for transport according to this packing instruction:

1) Section IB applies to lithium ion cells with a Watt-hour rating not exceeding 20 Wh and lithium ion batteries with a Watt-hour rating not exceeding 100 Wh packed in quantities that exceed the allowance permitted in Section IB, Table 965-IB; and

TABLE 965-IB

| | Net quantity per package Passenger aircraft | Net quantity per package Cargo Aircraft Only | |
|---------------------------------|--|---|-------|
| Lithium ion cells and batteries | 10 kg | 10 kg | |
| OUTER PACKAGINGS | | | |
| Type | Drums | Jerricans | Boxes |

2) Section II applies to lithium ion cells with a Watt-hour rating not exceeding 20 Wh and lithium ion batteries with a Watt-hour rating not exceeding 100 Wh packed in quantities not exceeding the allowance permitted in Section II, Table 965-II.

TABLE 965-II

| Contents | Lithium ion cells and/or batteries with a Watt-hour rating of 2.7 Wh or less | Lithium ion cells with a Watt-hour rating of more than 2.7 Wh but not more than 20 Wh | Lithium ion batteries with a Watt-hour rating of more than 2.7 Wh but not more than 100 Wh |
|---|--|---|--|
| 1 | 2 | 3 | 4 |
| Maximum number of cells/batteries per package | No limit | 8 cells | 2 Batteries |
| Maximum net quantity per package | 2.5 kg | N/A | N/A |

Cells and/or batteries specified in columns 2, 3 and 4 of Table 965-II must not be

combined in the same package.

Each cell or battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria Part 3 subsection 38.3.

The product has been evaluated according to the UN Manual of Tests and Criteria.

| No. | Test Item | Criteria | Result |
|--------|------------------------|---|--------|
| Test 1 | Altitude simulation | - After OCV (%) \geq 90% - No leakage, no venting, no disassembly, no rupture, no fire - Mass loss limit (leakage) 1) If $M < 1g$, less than 0.5%, 2) If $1g \leq M \leq 75g$, less than 0.2%, 3) If $M > 75g$, less than 0.1%) | Pass |
| Test 2 | Thermal test | | Pass |
| Test 3 | Vibration | | Pass |
| Test 4 | Shock | | Pass |
| Test 5 | External short circuit | - No disassembly, no rupture, no fire within 6 hours after the test - Max. Temp \leq 170°C | Pass |
| Test 6 | Impact or Crush | - No disassembly, no fire within 6 hours after the test - Max. Temp \leq 170°C | Pass |
| Test 7 | Overcharge | - No disassembly, no fire within 7 days after the test | Pass |
| Test 8 | Forced discharge | - No disassembly, no fire within 7 days after the test | Pass |

15. Regulatory Information

This product is not hazardous under the criteria of the Federal Occupational Safety and Health

Administration(OSHA) Hazard Communication Standard.(29 CFR 1910.1200)

IATA Dangerous Goods Regulations **57th** Edition Effective 1 January **2016**.

Hazardous Non-hazardous

16. Other Information

The data in this Product Safety Data Sheet relates only to the specific product designated herein and does not relate to use in combination with any other product or in any process. This PSDS may not meet regulatory requirements in other countries. This information is based on technical information believed to be reliable. It is subject to revision as additional knowledge and experiences are gained.

REFERENCE

International Chemical Safety Cards(ICSCs) International Occupational Safety and Health Information Centre(CIS) 0710 March 1999

Opinion of the scientific committee on toxicity, ecotoxicity and the environment(CSTEE)

Adopted by the CSTEE during the 43rd plenary meeting of 28 May 2004

UN-Recommendations on the Transport of Dangerous Goods Model Regulations.
(ST/SG/AC. 10/1/Rev.5/Amend.2)