

RISK ASSESSMENT

National
Deep
Submergence Facility

AUV SENTRY LITHIUM BATTERIES

S4205-0020XA



WOODS HOLE
OCEANOGRAPHIC
INSTITUTION

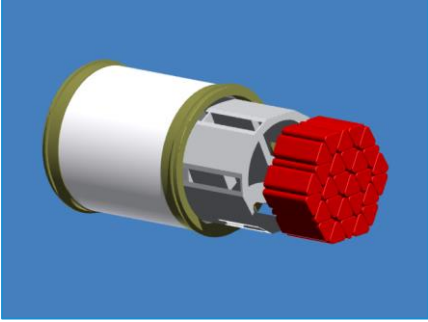
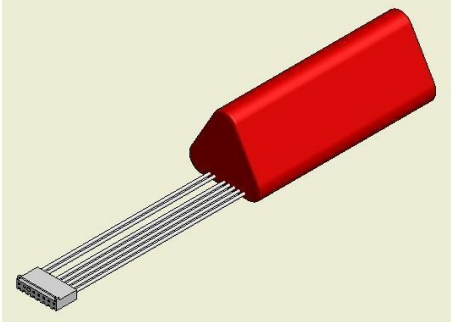
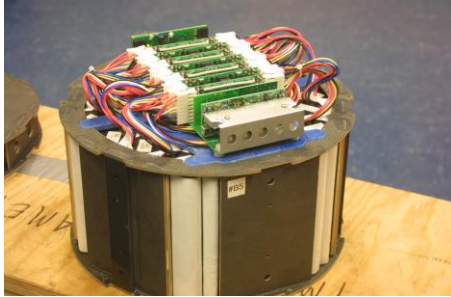
Revision	Date	Description	Author
A	27 JULY 2023	Initial release	S.Kelley

1. PURPOSE & SCOPE

A risk assessment is a systematic process of identifying, analyzing, and evaluating risks. It is an essential tool for any organization, regardless of size or industry. Risk assessments help organizations to identify and understand the risks they face. This includes identifying the potential hazards that could cause harm, as well as the likelihood and severity of those hazards. Assess the likelihood and severity of those risks. This involves assigning a numerical value to the likelihood and severity of each risk, so that they can be compared and prioritized. Identifying and implementing controls that can reduce the likelihood or severity of risks. Monitor and review risk levels on an ongoing basis. This involves regularly reviewing the risk assessment to ensure that it is still accurate and up to date. Risk assessments can also help organizations to comply with relevant regulations and standards.

2. SUMMARY

AUV Sentry is equipped with secondary lithium-ion battery cells. The battery cells are the primary power source of the AUV while submerged and operating subsea. The battery cells are COTS equipment and manufactured by Panasonic with part number NCR18650A, commonly used in laptops and household items. The cells have high energy density with stable power and run time characteristics that make them ideal for AUV operations. In total Sentry contains five battery buckets that are comprised of 28 shrink wrapped battery packs each with 12 cells inside. There is a total of 7,140 NCR18650A cells inside the vehicle with a combined energy density of roughly 325A/h. Specifications for the NCR18650A can be found in the appendix.

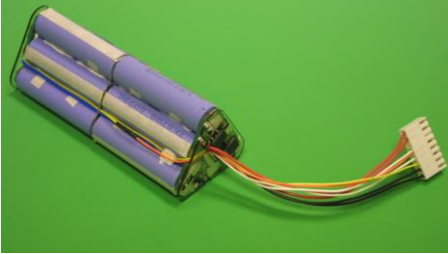
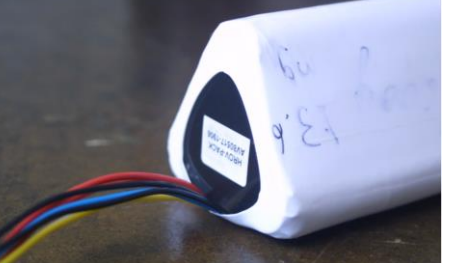
		
Battery Bucket model with 28 battery packs	Battery pack model containing 12 NCR18650A cells and protection circuits	Assembled battery pack with control electronics.

3. PACKAGING

The individual battery cells are layered with several types of insulation material. The cells are shrink wrapped and spot welded together with safety electronics that allow the packages to be class 9 designation and allowable for shipping. Each pack contains safety electronics to ensure the battery cells do not exceed manufacturer specifications for voltage and current. The pack passes transportation tests as defined in UN Manual of Tests

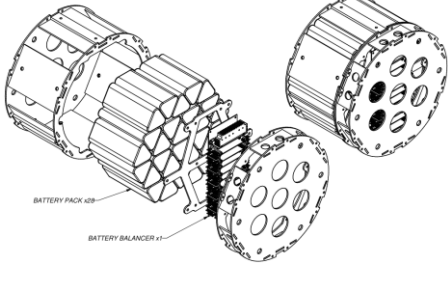
and Criteria, Part II, section 38.3, Fourth Revised Edition. The packaging around the cell assembly is surrounded by an abrasion resistant kapton sheet, covering the length of the cells, surrounded by plastic shrink wrap. The triangular ends of the pack are covered by fish paper, fiberglass or equivalent. The packs are assembled by Aved Electronics, a local company specializing in battery pack design and manufacturing.

4.1 Individual cell packaging

		
12 NCR18650A Cells wired in series with protection electronics and no wrapping.	Cell packaging before shrinkwrap showing kapton sheet covering the cells.	End of completed cell with shrink wrap and end covering.

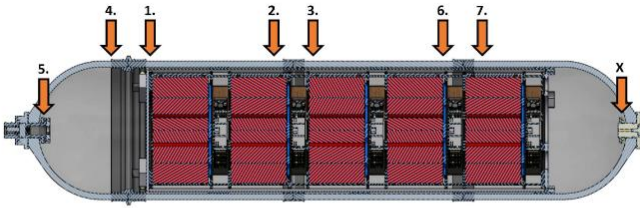
4.2 Battery Bucket assembly

The battery packs are packaged into another container, called the battery buckets. These buckets are comprised of 28 battery packs and contain all 28 cells in a way that constrains their movement, adds control and safety electronics, and provides mounting infrastructure for installation into the battery housing. The battery bucket is constructed of carbon fiber plywood and provides superior strength and weight performance. The water jet material is glued together to form a bucket that houses the batteries with a top hat assembly.

		
Battery Bucket assembly	Battery Bucket assembled without top hat and control electronics showing	Battery bucket assembled

4.3 Sentry Battery Housing

The battery buckets are contained inside a pressure housing on Sentry that allows for operations down to 6m depth. The housing is unique as it is rated to 6km and a mix of carbon and titanium in order to keep weight to a minimum while submerged. The battery housing has five battery buckets with a single penetrator that allows for power distribution and control. The endcap of the battery housing is held on by vacuum and has no clamp or device rigidly retaining the endcap to the primary housing. This is a key component to the battery housing that significantly reduces any likelihood of pressure build up from a potential battery failure. The housing also contains humidity, pressure, and temperature sensor.

 <table data-bbox="238 428 647 644"><thead><tr><th>Location ID</th><th>Description</th><th>Date Inspected</th></tr></thead><tbody><tr><td>1</td><td>Housing o-ring flange</td><td>6/6/2023</td></tr><tr><td>2</td><td>Near side of 1st joint ring</td><td>6/6/2023</td></tr><tr><td>3</td><td>Far side of 1st joint ring</td><td>6/6/2023</td></tr><tr><td>4</td><td>Endcap o-ring flange</td><td>6/6/2023</td></tr><tr><td>5</td><td>Endcap penetrator flange</td><td>6/6/2023</td></tr><tr><td>6</td><td>Near side of 2nd joint ring</td><td>6/7/2023</td></tr><tr><td>7</td><td>Far side of 2nd joint ring</td><td>6/7/2023</td></tr><tr><td>X</td><td>Housing penetrator flange</td><td>n/a</td></tr></tbody></table>	Location ID	Description	Date Inspected	1	Housing o-ring flange	6/6/2023	2	Near side of 1st joint ring	6/6/2023	3	Far side of 1st joint ring	6/6/2023	4	Endcap o-ring flange	6/6/2023	5	Endcap penetrator flange	6/6/2023	6	Near side of 2nd joint ring	6/7/2023	7	Far side of 2nd joint ring	6/7/2023	X	Housing penetrator flange	n/a	
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Assembly drawing of Ceramic housing	Ceramic Battery housing in the pressure test fixture. Pressure test fixture is not installed in vehicle.																											

4. STORAGE

The batteries buckets are installed in the submersible and remain inside the battery housing through shipping, at sea operations, and storage. They are shipped inside the housing along with a single spare battery bucket located in our spares container sealed inside a watertight pelican case. When the batteries are not used for more than a week they are stored at a voltage level provided by the manufacturer that is the most stable level for the chemistry of the battery. Proper lithium-ion batteries storage is critical for maintaining an optimum battery performance and reducing the risk of fire and/or explosion.

5. TRANSPORTATION

Transportation of the battery packs require minimal setup and handling. The batteries located inside the AUV are left in place and reduced to the storage voltage required for long term storage. The spare battery pack remains in the travel case with no action required. Storage requirements:

- If stored more than one week, batteries shall be at the storage voltage outlined by the manufacturer
- Batteries must be in the ‘off’ state such that discharge or charge is not possible
- Batteries installed in the AUV must be shipped without indication of a safety issue, such as overvoltage, undervoltage, over temp, etc.

6. OPERATIONAL USE SCENARIO

The batteries are turned on and in use when Sentry is preparing for dive operations and when Sentry is submerged. Outside of this window the batteries are either in an ‘off’ state or in a ‘charging’ state. Each state

is dependent on the operations and cadence of the cruise. Typically, the batteries are put on charge following a dive, but this can be delayed depending on the schedule and time between dives.

6.1 Discharge

The discharge state of the batteries allows for current draw from the battery and the state of the vehicle when it is considered 'on battery'. During the discharge state, the internal electronics of each battery closes an electrical switch that allows the batteries to discharge and supply voltage and current to various systems on the AUV. The discharge state is the primary state of the batteries when submerged. Each battery bucket can provide up to 12Amps max. The active load is dependent on the sensor package and largely variable depending on the type of mission.

6.2 Charge

The charge state is when the batteries are no longer discharging but under charge conditions which is when power is applied to the battery cells either in a constant current or constant voltage configuration. The charge can only be completed on deck and requires shore power connection to the vehicle and charge cables. Additionally, there are safety relays used for charging that disconnect the vehicle batteries from the vehicle and connect to the charge cables. Charging is controlled by an operator at the Sentry watch station. During charging the batteries are controlled by a software algorithm that monitors all aspects of the charging configuration in real time, including charge current, battery temperature and state of charge.

6.3 Off

considered in an off state when the electrical switches that allow for current draw from the batteries in either direction are electrically open. In the 'off' state, the batteries cannot supply power even when an electrical load is applied to the battery. While in the 'off' state the internal battery electronics are continually powered by the battery and monitoring the cell voltage and temperature constantly.

7. DISPOSAL INFORMATION

Not applicable for at sea applications, batteries are not disposed at sea.

RISK ASSESSMENT LITHIUM-ION BATTERIES

	Score	1	2	3	4	5
	Description	Insignificant	Minor	Moderate	Major	Catastrophic
Consequence	Example	Minor injury, no first aid required	Harmful injury (first aid required under 3 days recovery time)	Serious injury medical assistance required. Injury must be reported	Major injury, urgent medical assistance required	Fatality

Likelihood	Description	Rare	Unlikely	Possible	Likely	Almost certain

Risk matrix

Consequences	Catastrophic	5	5	10	15	20	25
	Major	4	4	8	12	16	20
	Moderate	3	3	6	9	12	15
	Minor	2	2	4	6	8	10
	Insignificant	1	1	2	3	4	5
			1	2	3	4	5
			Rare	Unlikely	Possible	Likely	Almost Certain
Likelihood/Probability							

Risk Rating Key	Low	Medium	High	Extreme
	Acceptable	As Low as reasonably Possible	Generally Unacceptable	Intolerable

RISK ASSESSMENT

Consequences	Likelihood	Activity	Hazard	Risk Control Measures
2	2	Charging – Over temp	Thermal Runaway	- Self monitoring for temperature and automatic shutoff 4 thermistors installed per battery pack - Housing temperature monitored
3	1	Discharging/Charging	Electrical Shock	- Checklist controls for charge cables - DC – Low voltage with low risk for arc-ing - Battery off condition required for any work
2	1	Discharging - Undervoltage	Damaged cells	- Self monitoring and shut off for undervoltage in Battery buckets - Software monitoring of battery bucket and automatic low voltage shutoff
3	1	Normal Operations	Chemical Release to Environment	- Battery monitoring system - Pre/post dive checks on housing status
3	1	Shipping & transit - Vibration	Wear and tear on components	- Rated to UN vibration test - Buckets are packaged such movement is minimized
1	1	Normal Operations – Pinched Wire (high Z)	Reduced performance	- Pre-dive decktest - Install and assembly procedures
4	1	Normal Operations	Toxic exposure	Battery removal can only be completed during conditions that allow for safe removal of the batteries

				On deck – if off gassing, personal should keep clear of the housing
5	1	Normal Operations	Battery Fire – On Deck	- Internal cell temperature control - Battery pack overvoltage limits - Battery pack fuse - Battery bucket fusing
5	1	Normal Operations	Battery housing flood	- Housing vacuum check before dive - Housing vacuum check following dive - Battery status through acoustics while submerged - Visual inspection of endcap during mobilization
2	3	Charging – Over Voltage	Thermal Runaway	- Internally battery monitoring system, self-protection that will turn off battery during charging if an overvoltage is sensed. - Fusing on battery pack - Persistent monitoring of cell voltages
4	1	Normal Operations – Pinched Wire (short)	Rapid discharge Arc-ing Fire hazard	- Pre/post dive checks - Battery performance plots post dive - Cell Fusing - Bucket fusing - Temperature sensors - Undervoltage limits
4	1	Normal Operations - Damage to Battery housing cylinder	Fire Hazard Flood hazard	- Internal housing sensor pre dive check - Internal fusing and voltage protections
5	2	Normal Operations – Cell internal Short	Battery fire	- Cells are purchased through reputable manufacturer - Test discharge and charge cycles and QA following receipt of new cells

8. REFERENCES

- Panasonic-Lilon-MSDS.pdf (Product Safety Data Sheet)
- NCR18650A-Panasonic.pdf (Panasonic – NCR18650A – Specifications)

PRODUCT SAFETY DATA SHEET

Manufacturer

Name of Company : Panasonic Corporation
Address : 1-1,Matsushita-cho,Moriguchi,Osaka 570-8511 Japan
Department : Energy Company Lithium-Ion Battery Business Unit
Representative : Iichiro Mori
Telephone number : +81-6-6991-1141
Facsimile number : +81-6-6994-4623
For emergency : +81-6-6991-1141

Document number: PLI-PSDS-2010-073

Issued : Dec. 7, 2010

Name of Product : Lithium-Ion battery (or, Lithium-Ion secondary battery)
(Model name) : NCR18650A

Substance Identification

Substance : Lithium-Ion battery
CAS number : Not specified
UN Class : Even classified as lithium ion batteries UN3480 or UN3481(Contained in Equipment or Packed with Equipment), the product is handled as Non-Dangerous Goods by meeting the UN Recommendations on the Transportation of Dangerous Goods Model Regulations Special Provision SP188 and IATA Dangerous Goods Regulations Packing Instruction 965-967 General Requirement and Section II (Excepted) is applied for air transportation, IMDG Code SP188 is applied for marine transportation. (1)(2)(3)

Composition : Positive electrode; Lithium nickel oxide 20—35wt%
Negative electrode; Carbon 10—20wt%
Electrolyte; Organic electrolyte (mainly composed of alkyl carbonate) 10—20wt%
Enclosure; Plastic

Hazardous and Toxicity Class

Class name : Not applicable for regulated class
Hazard : It may cause heat generation or electrolyte leakage if battery terminals contact with other metals. Electrolyte is flammable. In case of electrolyte leakage, move the battery from fire immediately.
Toxicity : Vapor generated from burning batteries, may make eyes, skin and throat irritate.

First Aid Measures

The product contains organic electrolyte. In case of electrolyte leakage from the battery, actions described below are required.

Eye contact	: Flush the eyes with plenty of clean water for at least 15 minutes immediately, without rubbing. Take a medical treatment. If appropriate procedures are not taken, this may cause an eye irritation.
Skin contact	: Wash the contact areas off immediately with plenty of water and soap. If appropriate procedures are not taken, this may cause sores on the skin.
Inhalation	: Remove to fresh air immediately. Take a medical treatment.

Fire Fighting Measures

Extinguishing method : Since vapor, generated from burning batteries may make eyes, nose and throat irritate, be sure to extinguish the fire on the windward side. Wear the respiratory protection equipment in some cases.

Fire extinguishing agent : Plenty of water and alcohol-resistant foam are effective.

Measures for electrolyte leakage from the battery

- Take up with absorbent cloth.
 - Move the battery away from the fire.
-

Handling and Storage

- When packing the batteries, do not allow battery terminals to contact each other, or contact with other metals. Be sure to pack batteries by providing partitions in the packaging box, or in a separate plastic bag so that the single batteries are not mixed together. (1)(2)(3)
 - Use strong material for packaging boxes so that they will not be damaged by vibration, impact, dropping and stacking during their transportation. (1)(2)(3)
 - Do not let water penetrate into packaging boxes during their storage and transportation.
 - The batteries will be stored at room temperature, charged to about 30—50% of capacity.
 - Do not store the battery in places of the high temperature exceeding 35 deg. C or under direct sunlight or in front of a stove. Please also avoid the places of high humidity. Be sure not to expose the battery to condensation, water drop or not to store it under frozen condition.
 - Batteries are sure to be packed in such a way as to prevent short circuits under conditions normally encountered in transport. (1)(2)(3)
 - Please avoid storing the battery in the places where it is exposed to the static electricity so that no damage will not be caused to the protection circuit of the battery pack.
-

Exposure Control (in case of electrolyte leakage from the battery)

Acceptable concentration	: Not specified in ACGIH. (4)
Facilities	: Provide appropriate ventilation system such as local ventilator in the storage place.

Protective clothing : Gas mask for organic gases, safety goggle, safety glove.

Physical and Chemical Properties of Single cell

Appearance : Single cell: Cylindrical or Prismatic cell
Nominal voltage : Single cell: 3.6 volts

Stability and Reactivity

Since batteries utilize a chemical reaction they are actually considered a chemical product. As such, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage.

Toxicological Information (in case of electrolyte leakage from the battery)

Acute toxicity : Oral (rat) LD50 >2g/kg (estimated)
Irritation : Irritating to eyes and skin.
Mutagenicity : Not specified.
Chronic toxicity : Not specified.

Ecological Information

- In case of the worn-out battery was disposed in land, the battery case may be corroded, and leak electrolyte. But, we have no ecological information.

Heavy metal in battery : Mercury(Hg) and Cadmium(Cd) are neither contained nor used in battery.

Disposal Considerations (Precautions for recycling)

- When the battery is worn out, dispose of it under the ordinance of each local government or the law issued by relating government.
 - Disposal of the worn-out battery may be subjected to Collection and Recycling Regulation.
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Transport Information

- Even classified as lithium ion batteries UN3480 or UN3481(Contained in Equipment or Packed with Equipment), the product is handled as Non-Dangerous Goods by meeting the UN Recommendations on the Transportation of Dangerous Goods Model Regulations Special Provision SP188. (1)
 - (a) For a lithium-ion cell, the Watt-hour rating is not more than 20 Wh;
 - (b) For a lithium-ion battery, the Watt-hour rating is not more than 100 Wh.

Lithium ion batteries subject to this provision shall be marked with the Watt-hour rating on the outside case, except those manufactured before 1 January 2009 which may be transported in accordance with this special provision and without this marking until 31 December 2010;

- (c) Each cell or battery is of the type proved to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, sub-section 38.3 ;
 - (d) Cells and batteries, except when installed in equipment, shall be packed in inner packagings that completely enclose the cell or battery. Cells and batteries shall be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit. The inner packagings shall be packed in strong outer packagings ;
 - (e) Cells and batteries when installed in equipment shall be protected from damage and short circuit, and the equipment shall be equipped with an effective means of preventing accidental activation. When batteries are installed in equipment, the equipment shall be packed in strong outer packagings constructed of suitable material of adequate strength and design in relation to the packaging's capacity and its intended use unless the battery is afforded equivalent protection by the equipment in which it is contained;
 - (f) Except for packages containing button cell batteries installed in equipment (including circuit boards), or no more than four cells installed in equipment or no more than two batteries installed in equipment, each package shall be marked with the following:
 - (i) an indication that the package contains "lithium ion" cells or batteries, as appropriate;
 - (ii) an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged;
 - (iii) an indication that special procedures shall be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - (iv) a telephone number for additional information;
 - (g) Each consignment of one or more packages marked in accordance with paragraph (f) shall be accompanied with a document including the following:
 - (i) an indication that the package contains "lithium ion" cells or batteries, as appropriate;
 - (ii) an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged;
 - (iii) an indication that special procedures shall be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - (iv) a telephone number for additional information;
 - (h) Except when batteries are installed in equipment, each package shall be capable of withstanding a 1.2 m drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery to battery (or cell to cell) contact and without release of contents: and
 - (i) Except when batteries are contained in or packed with equipment, packages shall not exceed 30 kg gross mass for marine transportation. (not exceed 10kg for air transportation)
- For marine transportation the product is handled as Non-Dangerous Goods by meeting the IMO International Maritime Dangerous Goods (IMDG Code) 2008 Edition (Amendment 34-08) SP188 (Same as UN Special Provision SP188 above).(3)
 - For air transportation the product is handled as Non-Dangerous Goods by meeting the IATA Dangerous Goods Regulations 51st Edition Effective 1 January 2010 Packing Instruction 965-967 General Requirement and Section II (Excepted) and UN Special Provision SP188 above.(2)
 - (j) Lithium ion batteries identified by manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).
 - (k) Each package contains more than four cells or more than two batteries must be labeled with a lithium battery handling label.
 - * The width 120mm X length 110mm sized lithium battery handling label must be labeled onto the side of a package without bending it.
 - (l) The words "Lithium ion batteries", "not restricted" and "PI number" must be included in the Additional

Handling Information on the air waybill, when an air waybill is used.

(PI number Cell and Battery : PI965, Packed with Equipment : PI966, Contained in Equipment : PI967)

- (m) Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.
 - (n) Except when batteries are installed in or packed with equipment, packages shall not exceed 10kg gross mass.
- The Lithium-Ion cells or batteries as stated in Appendix are made in compliance to the requirements stated in the latest edition of the IATA Dangerous Goods Regulations Packing Instruction 965 General requirements and Section II, such that they can be transported as a NOT RESTRICTED (non-hazardous/non-dangerous) goods. However, if those lithium-ion cells or batteries are packed with or contained in an equipment, then it is the responsibility of the shipper to ensure that the consignment are packed in compliance to the latest edition of the IATA Dangerous Goods Regulations General requirements and Section II Packing Instruction 966 or 967 in order for that consignment to be declared as NOT RESTRICTED (non-hazardous/non-Dangerous).
 - During the transportation of a large amount of batteries by ship, trailer or railway, do not leave them in the places of high temperatures and do not allow them to be exposed to condensation.
 - During the transportation do not allow packages to be fallen down or damaged.
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Regulatory Information

- UN (United Nations): Recommendations on the Transportation of Dangerous Goods Model Regulations
Sixteenth revised edition
 - ICAO (International Civil Aviation Organization) : Technical Instructions for the safety transport of dangerous goods by air 2009-2010 Edition
 - IATA (International Air Transport Organization) : Dangerous Goods Regulations 51st Edition
Effective 1 January 2010
 - IMO (International Maritime Organization) : International Maritime Dangerous Goods (IMDG) Code
2008 Edition (Amendment 34-08)
-

Others

References

- (1) UN (United Nations) : Recommendations on the Transportation of Dangerous Goods Model Regulations
Sixteenth revised edition
 - (2) IATA (International Air Transport Organization) : Dangerous Goods Regulations 51st Edition,
Effective 1 January 2010.
 - (3) IMO (International Maritime Organization) : International Maritime Dangerous Goods (IMDG) Code
2008 Edition (Amendment 34-08).
 - (4) TLVs and BEIs 1999 ACGIH
-

製品安全データシート

PRODUCT SAFETY DATA SHEET

製造者情報

会社 パナソニック株式会社 エナジー社
 住所 〒570-8511 大阪府守口市松下町 1 番 1 号
 担当部門 : リチウムイオン電池ビジネスユニット
 商品技術グループ
 担当者 : 海谷 英男
 電話番号 : 06-6994-4654
 F A X 番号 : 06-6991-6140
 緊急連絡先 : 担当部門と同じ
 休日対応電話番号: 06-6991-1141

整理番号 PLI-PSDS-14A-2009

作成・改定 2009年 2月 5日

Manufacturer

Name of Company : Panasonic Corporation Energy Company.
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 Telephone number : +81-6-6994-4654
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 For emergency : Tel. (Working hours) +81-6-6994-4654
 : Tel. (Holiday) +81-6-6991-1141

Document number: PLI-PSDS-14A-2009

Issued or revised date: February 5, 2009

製品名

リチウムイオン電池 (別名 リチウムイオン二次電池)

(モデル名)

NCR18650

Name of Product

Lithium ion rechargeable cell (or, Lithium ion secondary cell)

(Model name)

NCR18650

物質の特定 物質名 : リチウムイオン電池

C A S No. : 指定されない

国連分類 : リチウムイオン電池(UN3480)に分類されるが、2009IATA危険物規則書50版 包装規則965 パート1 が適用される。従って、リチウムイオン電池は下記要求を満たすことによって非危険物として取り扱われる。(1)

*リチウムイオン単電池の場合、Wh値が20Wh以下、かつ国連勧告安全性試験に合格した場合、国連分類上、危険物除外となる。(1)(2)
特別規程A154に該当するものは範囲外で、A164には適合する。(2)

主な材料の含有量 :

正極	; ニッケル酸リチウム	20～35wt%
負極	; カーボン	10～20wt%
電解液	; 炭酸エステルを主とする有機電解液 (危険物第4類第2石油類)	10～20wt%

Substance Identification

Substance : Lithium ion rechargeable cell

CAS number : Not specified.

UN Class : Even classified as lithium ion batteries (UN3480), 2009IATA Dangerous Goods Regulations 50th edition Packing Instruction 965 Part 1 is applied. The product is handled as Non-Dangerous Goods by meeting the following requirements. (1)

Lithium ion cells offered for transport are not subject to the other additional requirements of the UN Regulations if they meet the following. (1)(2)

- The Watt-hour rating is not more than 20Wh.
- Each cell is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, sub-section 38.3

And they are out of scope for Special Provision A154 and comply with special Provision A164.(2)

Composition	: Positive electrode; Lithium cobalt oxide	20－35wt%
	Negative electrode; Carbon	10－20wt%
	Electrolyte; Organic electrolyte mainly composed of alkyl carbonate	10－20wt%

危険有害性の分類

分類の名称 : 該当しない

危険性 : 電池の正負極端子を金属片等で短絡させると発熱、液漏れのおそれがある。電解液が流出した場合は引火性があるので、直ちに火気より遠ざける。

有害性 : 電池が燃焼した場合、発生した蒸気は、目、皮膚、のどを刺激するおそれがある。

Hazardous and Toxicity Class

Class name	: Not applicable for regulated class
Hazard	: It may cause heat generation or electrolyte leakage if battery terminals contact with other metals. Electrolyte is flammable. In case of electrolyte leakage, move the battery from fire immediately.
Toxicity	: Vapor generated from burning batteries, may make eyes, skin and throat irritate.

応急処置

製品から電解液が漏液した場合の措置について以下記載する。

目に入った場合 : こすらずに、直ちに水道水で15分以上洗った後に、医師の診断を受ける。放置すると目に障害を与えるおそれがある。

皮膚に付着した場合 : 石鹼を使用して水で十分に洗い流す。放置すると皮膚に炎症を引き起こすおそれがある。

吸引した場合 : 直ちに新鮮な空気のある場所に移動し安静を保ち、医者への診断を受ける。

First Aid Measures

The product contains organic electrolyte. In case of electrolyte leakage from the battery, actions described below are required.

Eye contact : Flush the eyes with plenty of clean water for at least 15 minutes immediately, without rubbing. Take a medical treatment. If appropriate procedures are not taken, this may cause an eye irritation.

Skin contact : Wash the contact areas off immediately with plenty of water and soap. If appropriate procedures are not taken, this may cause sores on the skin.

Inhalation : Remove to fresh air immediately. Take a medical treatment.

火災時の措置

消火方法 : 燃焼時の蒸気は目、鼻、のどを刺激するおそれがあるので、消火作業は、風上から行い、場合によっては呼吸保護具を着用する。

消火剤 : 大量の水、泡消火薬剤が有効である。

Fire Fighting Measures

Extinguishing method : Since vapor, generated from burning batteries may make eyes, nose and throat irritate, be sure to extinguish the fire on the windward side. Wear the respiratory protection equipment in some cases.

Fire extinguishing agent : Plenty of water and alcohol-resistant foam are effective.

漏出時の措置（電解液が製品から漏出した場合）

- ・ 乾布で拭き取る。
- ・ 火気より遠ざける。

Measures for electrolyte leakage from the battery

- Take up with absorbent cloth.
 - Move the battery away from the fire.
-

取扱い及び保管上の注意

- ・ 電池の端子は外部ショートを防止するために、個々に仕切られた状態で梱包するか、又は個々にプラスチック袋に梱包する。(1)
- ・ 保管、輸送時には雨水などでぬらさない。
- ・ 電池を保存する場合は電池容量を30～50%にして、常温で保存することを推奨する。
- ・ 35℃以上の高温、直射日光、ストーブなどの熱源近く、多湿、結露、水滴、凍結下での保存は、避ける。
- ・ 通常の取り扱いで誤って梱包が破損しても、電池の端子間ショートが発生しない梱包方法とする。(1)
- ・ 電池パックに組み込まれている保護装置が損傷するような静電気の発生装置の近くは避ける。
- ・ 多量の電池を保管する場合は消防法の適応を受ける場合がある。(6)

Handling and Storage

- When packing the cells, do not allow battery terminals to contact each other, or contact with other metals. Be sure to pack batteries by providing partitions in the packaging box, or in a separate plastic bag so that the single batteries are not mixed together. (1)
 - Do not let water penetrate into packaging boxes during their storage and transportation.
 - The Cell will be stored at room temperature, charged to about 30—50% of capacity.
 - Do not store the cell in places of the high temperature exceeding 35 deg. C or under direct sunlight or in front of a stove. Please also avoid the places of high humidity. Be sure not to expose the cell to condensation, water drop or not to store it under frozen condition.
 - Cells are sure to be packed in such a way as to prevent short circuits under conditions normally encountered in transport. (1)
 - Please avoid storing the battery in the places where it is exposed to the static electricity so that no damage will not be caused to the protection circuit of the battery pack.
-

暴露防止措置 (電解液が製品から漏出した場合)

- 許容濃度 : 日本産業衛生学会, A C G I Hには規定されていない。(4)(5)
 設備対策 : 保管場所については局所排気装置を使用するなど、換気に注意する。
 保護具 : ガスマスク (有機ガス用), 保護眼鏡, 保護手袋

Exposure Control (in case of electrolyte leakage from the battery)

- Acceptable concentration : Not specified in ACGIH. (4)
 Facilities : Provide appropriate ventilation system such as local ventilator in the storage place.
 Protective clothing : Gas mask for organic gases, safety goggles, safety gloves.

物理／化学的性質

- 外観等 : 単電池は円筒形、又は角形
 公称電圧 : 単電池で 3.6 V

Physical and Chemical Properties

- Appearance : Single cell: Cylindrical or Prismatic cell
 Nominal voltage : Single cell: 3.6 volts

安定性及び反応性

電池は化学反応を利用した、いわゆる化学製品であり、使用した場合はもちろん、長期間の放置によっても性能劣化が生じる。また、実際の使用において充電、放電、温度などが適正条件に保たれない場合はサイクル寿命劣化や漏液による性能劣化、機器損傷の恐れがある。

Stability and Reactivity

Since batteries utilize a chemical reaction they are actually considered a chemical product. As such, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage.

有害性情報 (電解液が製品から漏出した場合)

急性毒性	: 経口 ラット LD50 >2g/kg (推定)
刺激性	: 皮膚, 目に刺激性あり。
変異原性	: 設定されていない。
慢性毒性	: 設定されていない。

Toxicological Information (in case of electrolyte leakage from the battery)

Acute toxicity	: Oral (rat) LD50 >2g/kg (estimated)
Irritation	: Irritating to eyes and skin.
Mutagenicity	: Not specified.
Chronic toxicity	: Not specified.

環境影響情報

- ・使用済み電池が土中に埋め立てられた場合、電池缶が腐食し内部の電解液が浸出してくることが考えられるが、環境影響への情報はない。
- ・単セル中の重金属
水銀 (Hg) およびカドミウム (Cd) は含まれていないし、用いてもいない。

Ecological Information

- In case of the worn-out cell was disposed in land, the cell case may be corroded, and leak electrolyte. But, we have no ecological information.
- Heavy metal in cell
Mercury(Hg) and Cadmium(Cd) are neither contained nor used in cell

廃棄上の注意 (リサイクル上の注意)

- ・廃棄電池であっても多量の保管は、消防法の適応を受ける場合がある。 (6)
- ・使用済み電池の廃棄は、法律ならびに各地方自治体の条例に従うこと。
- ・使用済み電池は、資源有効利用促進法の適応をうける。

Disposal Considerations (Precautions for recycling)

- When the battery is worn out, dispose of it under the ordinance of each local government or the law issued by relating government.
- Disposal of the worn-out battery may be subjected to Collection and Recycling Regulation.

輸送上の注意(1),(2)

- ・ 製造者により安全上の理由で欠陥品と認められた、損傷して発熱、発火、短絡などの危険な状態を引き起こす恐れのあるリチウムイオン電池は輸送が禁止される。
(例えば、安全上の理由から製造者に返品されたリチウムイオン電池)
- ・ 航空機輸送は、機器に組み込まれている場合を除き、個数に関係なく 1 個以上の単電池、および組電池を含む包装物は、次の追加条件を満たさなければならない。(1)(2)
 1. 各積荷は以下の内容を明記したドキュメントを添付しなければならない。
 - ・ 包装物にリチウムイオン電池が収納されていること。
 - ・ 包装物が損傷を受けた場合、発火の危険があるため丁寧に取り扱いなくてはならないこと。
 - ・ 包装物が損傷を受けた場合に従うべき手順を記載したドキュメントの添付。
必要であれば、検査と再梱包も含まれる。
 - ・ 緊急連絡先電話番号。
 2. 各包装物にはリチウムバッテリーハンドリングラベルを添付しなければならない。
 - ＊ 120mm×110mmのサイズのリチウムバッテリーハンドリングラベルを包装物の側面に折り曲げないで貼付すること。
 3. 各包装物はあらゆる向きでの1.2mの落下テストでの以下の項目に対する保証。
 - ・ 包装物内のリチウムイオン単電池及びリチウムイオン組電池の損傷の無いこと。
 - ・ 包装物内のリチウムイオン単電池及びリチウムイオン組電池が接触するような移動の無いこと。
 - ・ 包装物内の内容物が外に飛び出さないこと。
 4. 1梱包は10kg以下とする。
 5. 単電池5セル、組電池3パック以上が機器に組み込まれている場合は、上記1.及び2.が必要となる。
- ・ 船舶，トラック，鉄道による大量輸送の場合は、高温放置，結露等を避ける。
- ・ 荷崩れ，梱包破損の可能性のある輸送は避ける。
- ・ 組電池（複数のセルを組合せた電池）を輸送する際は国連勧告、IATA危険物規則書に従うこと。

Transport Information (1),(2)

- ・ Lithium ion batteries identified by manufacturer as being defective for safety reason, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport(e.g. those being returned to the manufacturer for safety reasons).

-
- Except when installed in equipment, for air shipment that contain one or more cells or batteries, they are necessary to meet the following items.
 1. Each consignment must be accompanied with a document such as air waybill with an indication that ;
 - the package contains lithium ion cells and batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary ; and
 - a telephone number for additional information.
 2. Each package must be labeled with a lithium battery handling label.
*The width 120mm * length 110mm sized lithium battery handling label must be labeled onto the side of a package without bending it.
 3. Each package must be capable of withstanding a 1.2m drop test in any orientation.
 - damage to cells or batteries contained therein;
 - shifting of the contents so as to allow battery to battery(or cell to cell) contact;
 - releaser of contents.
 4. Quantity per package shall not exceed 10kg.
 5. Each package containing more than five cells or more than three batteries installed in equipment must be complied with above item 1 and 2.

-During the transportation of a large amount of cells by ship, trailer or railway, do not leave them in the places of high temperatures and do not allow them to be exposed to condensation.

-During the transportation do not allow packages to be fallen down or damaged.

Transportation of Batteries (assembled over two cells) is subjected to
UN –Recommendations and IATA Dangerous Good Regulations.

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適用法令

- ・ 消防法
- ・ 航空法
- ・ 船舶安全法
- ・ 資源有効利用促進法
- ・ IATA 危険物規則書50版

Regulatory Information

- IATA Dangerous Goods Regulations 50th Edition Effective 1 January 2009
- ICAO Technical Instructions for the safe transport of dangerous goods by air

その他

引用文献

- (1) UNITED NATIONS 危険物輸送専門家委員会勧告 (ST/SG/AC.10/1/Rev.12)
- (2) IATA 危険物規則書50版 (Effective 1 January 2009)
- (3) リチウム及びリチウムイオン電池の輸送に関する手引書第2版 社団法人 電池工業会
- (4) TLV s and BEI s 1999 ACGIH
- (5) 許容濃度提案理由書集(1962－1993年) 日本産業衛生学会編 H6.9.30第1版
- (6) 注解消防関係法規集 2002年新版

Others

References

- (1) UN Recommendations on the Transportation of Dangerous Goods Model Regulations
(ST/SG/AC.10/1/Rev.12)
 - (2) IATA Dangerous Goods Regulations 50th Edition Effective 1 January 2009
 - (3) Manual for Transport of Lithium/Lithium Ion Batteries 2nd Edition Battery Association of Japan
 - (4) TLV s and BEI s 1999 ACGIH
-

PRODUCT SAFETY DATA SHEET

Manufacturer

Name of Company : Panasonic Corporation
Address : 1-1,Matsushita-cho,Moriguchi,Osaka 570-8511 Japan
Department : Energy Company Lithium-Ion Battery Business Unit
Representative : Iichiro Mori
Telephone number : +81-6-6991-1141
Facsimile number : +81-6-6994-4623
For emergency : +81-6-6991-1141

Document number: PLI-PSDS-2010-060

Issued : Sep. 27, 2010

Name of Product Lithium-Ion battery (or, Lithium-Ion secondary battery)

(Model name) CGR14500 / CGR18650CG / CGR18650CH / CGR18650DA / CGR18650K /
CGR18650KA / CGR26650A / CGR26650B

Substance Identification

Substance : Lithium-Ion battery
CAS number : Not specified
UN Class : Even classified as lithium ion batteries UN3480 or UN3481(Contained in Equipment or Packed with Equipment), the product is handled as Non-Dangerous Goods by meeting the UN Recommendations on the Transportation of Dangerous Goods Model Regulations Special Provision SP188 and IATA Dangerous Goods Regulations Packing Instruction 965-967 General Requirement and Section II (Excepted) is applied for air transportation, IMDG Code SP188 is applied for marine transportation. (1)(2)(3)

Composition : Positive electrode; Lithium nickel manganese cobalt oxide 20—35wt%
Negative electrode; Carbon 10—20wt%
Electrolyte; Organic electrolyte (mainly composed of alkyl carbonate) 10—20wt%
Enclosure; Plastic

Hazardous and Toxicity Class

Class name : Not applicable for regulated class
Hazard : It may cause heat generation or electrolyte leakage if battery terminals contact with other metals. Electrolyte is flammable. In case of electrolyte leakage, move the battery from fire immediately.
Toxicity : Vapor generated from burning batteries, may make eyes, skin and throat irritate.

First Aid Measures

The product contains organic electrolyte. In case of electrolyte leakage from the battery, actions described below are required.

Eye contact	: Flush the eyes with plenty of clean water for at least 15 minutes immediately, without rubbing. Take a medical treatment. If appropriate procedures are not taken, this may cause an eye irritation.
Skin contact	: Wash the contact areas off immediately with plenty of water and soap. If appropriate procedures are not taken, this may cause sores on the skin.
Inhalation	: Remove to fresh air immediately. Take a medical treatment.

Fire Fighting Measures

Extinguishing method	: Since vapor, generated from burning batteries may make eyes, nose and throat irritate, be sure to extinguish the fire on the windward side. Wear the respiratory protection equipment in some cases.
Fire extinguishing agent	: Plenty of water and alcohol-resistant foam are effective.

Measures for electrolyte leakage from the battery

- Take up with absorbent cloth.
 - Move the battery away from the fire.
-

Handling and Storage

- When packing the batteries, do not allow battery terminals to contact each other, or contact with other metals. Be sure to pack batteries by providing partitions in the packaging box, or in a separate plastic bag so that the single batteries are not mixed together. (1)(2)(3)
 - Use strong material for packaging boxes so that they will not be damaged by vibration, impact, dropping and stacking during their transportation. (1)(2)(3)
 - Do not let water penetrate into packaging boxes during their storage and transportation.
 - The batteries will be stored at room temperature, charged to about 30—50% of capacity.
 - Do not store the battery in places of the high temperature exceeding 35 deg. C or under direct sunlight or in front of a stove. Please also avoid the places of high humidity. Be sure not to expose the battery to condensation, water drop or not to store it under frozen condition.
 - Batteries are sure to be packed in such a way as to prevent short circuits under conditions normally encountered in transport. (1)(2)(3)
 - Please avoid storing the battery in the places where it is exposed to the static electricity so that no damage will not be caused to the protection circuit of the battery pack.
-

Exposure Control (in case of electrolyte leakage from the battery)

Acceptable concentration : Not specified in ACGIH. (4)
Facilities : Provide appropriate ventilation system such as local ventilator in the storage place.
Protective clothing : Gas mask for organic gases, safety goggle, safety glove.

Physical and Chemical Properties of Single cell

Appearance : Single cell: Cylindrical or Prismatic cell
Nominal voltage : Single cell: 3.6 volts

Stability and Reactivity

Since batteries utilize a chemical reaction they are actually considered a chemical product.
As such, battery performance will deteriorate over time even if stored for a long period of time without being used.
In addition, the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage.

Toxicological Information (in case of electrolyte leakage from the battery)

Acute toxicity : Oral (rat) LD50 >2g/kg (estimated)
Irritation : Irritating to eyes and skin.
Mutagenicity : Not specified.
Chronic toxicity : Not specified.

Ecological Information

- In case of the worn-out battery was disposed in land, the battery case may be corroded, and leak electrolyte. But, we have no ecological information.

Heavy metal in battery : Mercury(Hg) and Cadmium(Cd) are neither contained nor used in battery.

Disposal Considerations (Precautions for recycling)

- When the battery is worn out, dispose of it under the ordinance of each local government or the law issued by relating government.
 - Disposal of the worn-out battery may be subjected to Collection and Recycling Regulation.
-

Transport Information

- Even classified as lithium ion batteries UN3480 or UN3481(Contained in Equipment or Packed with Equipment), the product is handled as Non-Dangerous Goods by meeting the UN Recommendations on the Transportation of Dangerous Goods Model Regulations Special Provision SP188. (1)

- (a) For a lithium-ion cell, the Watt-hour rating is not more than 20 Wh;
 - (b) For a lithium-ion battery, the Watt-hour rating is not more than 100 Wh.
Lithium ion batteries subject to this provision shall be marked with the Watt-hour rating on the outside case, except those manufactured before 1 January 2009 which may be transported in accordance with this special provision and without this marking until 31 December 2010;
 - (c) Each cell or battery is of the type proved to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, sub-section 38.3 ;
 - (d) Cells and batteries, except when installed in equipment, shall be packed in inner packagings that completely enclose the cell or battery. Cells and batteries shall be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit. The inner packagings shall be packed in strong outer packagings ;
 - (e) Cells and batteries when installed in equipment shall be protected from damage and short circuit, and the equipment shall be equipped with an effective means of preventing accidental activation. When batteries are installed in equipment, the equipment shall be packed in strong outer packagings constructed of suitable material of adequate strength and design in relation to the packaging's capacity and its intended use unless the battery is afforded equivalent protection by the equipment in which it is contained;
 - (f) Except for packages containing button cell batteries installed in equipment (including circuit boards), or no more than four cells installed in equipment or no more than two batteries installed in equipment, each package shall be marked with the following:
 - (i) an indication that the package contains "lithium ion" cells or batteries, as appropriate;
 - (ii) an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged;
 - (iii) an indication that special procedures shall be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - (iv) a telephone number for additional information;
 - (g) Each consignment of one or more packages marked in accordance with paragraph (f) shall be accompanied with a document including the following:
 - (i) an indication that the package contains "lithium ion" cells or batteries, as appropriate;
 - (ii) an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged;
 - (iii) an indication that special procedures shall be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - (iv) a telephone number for additional information;
 - (h) Except when batteries are installed in equipment, each package shall be capable of withstanding a 1.2 m drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery to battery (or cell to cell) contact and without release of contents: and
 - (i) Except when batteries are contained in or packed with equipment, packages shall not exceed 30 kg gross mass for marine transportation. (not exceed 10kg for air transportation)
- For marine transportation the product is handled as Non-Dangerous Goods by meeting the IMO International Maritime Dangerous Goods (IMDG Code) 2008 Edition (Amendment 43-08) SP188 (Same as UN Special Provision SP188 above).(3)
 - For air transportation the product is handled as Non-Dangerous Goods by meeting the IATA Dangerous Goods Regulations 51st Edition Effective 1 January 2010 Packing Instruction 965-967 General Requirement and Section II (Excepted) and UN Special Provision SP188 above.(2)
 - (j) Lithium ion batteries identified by manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).
 - (k) Each package contains more than four cells or more than two batteries must be labeled with a lithium battery handling label.
* The width 120mm X length 110mm sized lithium battery handling label must be labeled onto the side of a package without bending it.

- (l) The words “Lithium ion batteries”, “not restricted” and “PI number” must be included in the Additional Handling Information on the air waybill, when an air waybill is used.
(PI number Cell and Battery : PI965, Packed with Equipment : PI966, Contained in Equipment : PI967)
 - (m) Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.
 - (n) Except when batteries are installed in or packed with equipment, packages shall not exceed 10kg gross mass.
- The Lithium-Ion cells or batteries as stated in Appendix are made in compliance to the requirements stated in the latest edition of the IATA Dangerous Goods Regulations Packing Instruction 965 General requirements and Section II, such that they can be transported as a NOT RESTRICTED (non-hazardous/non-dangerous) goods. However, if those lithium-ion cells or batteries are packed with or contained in an equipment, then it is the responsibility of the shipper to ensure that the consignment are packed in compliance to the latest edition of the IATA Dangerous Goods Regulations General requirements and Section II Packing Instruction 966 or 967 in order for that consignment to be declared as NOT RESTRICTED (non-hazardous/non-Dangerous).
 - During the transportation of a large amount of batteries by ship, trailer or railway, do not leave them in the places of high temperatures and do not allow them to be exposed to condensation.
 - During the transportation do not allow packages to be fallen down or damaged.

Regulatory Information

- UN (United Nations): Recommendations on the Transportation of Dangerous Goods Model Regulations
Sixteenth revised edition
- ICAO (International Civil Aviation Organization) : Technical Instructions for the safety transport of dangerous goods by air 2009-2010 Edition
- IATA (International Air Transport Organization) : Dangerous Goods Regulations 51st Edition
Effective 1 January 2010
- IMO (International Maritime Organization) : International Maritime Dangerous Goods (IMDG) Code
2008 Edition (Amendment 43-08)

Others

References

- (1) UN (United Nations) : Recommendations on the Transportation of Dangerous Goods Model Regulations
Sixteenth revised edition
- (2) IATA (International Air Transport Organization) : Dangerous Goods Regulations 51st Edition,
Effective 1 January 2010.
- (3) IMO (International Maritime Organization) : International Maritime Dangerous Goods (IMDG) Code
2008 Edition (Amendment 43-08).
- (4) TLVs and BEIs 1999 ACGIH

製品安全データシート

PRODUCT SAFETY DATA SHEET

製造者情報

会社 パナソニック株式会社 エナジー社
 住所 〒570-8511 大阪府守口市松下町 1 番 1 号
 担当部門 : リチウムイオン電池ビジネスユニット
 商品技術グループ
 担当者 : 海谷 英男
 電話番号 : 06-6994-4654
 F A X 番号 : 06-6991-6140
 緊急連絡先 : 担当部門と同じ
 休日対応電話番号: 06-6991-1141

整理番号 PLI-PSDS-17A-2009

作成・改定 2009年 2月 5日

Manufacturer

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Document number: PLI-PSDS-17A-2009

Issued or revised date: February 5, 2009

製品名

リチウムイオン電池 (別名 リチウムイオン二次電池)

(モデル名)

CGR18650E / CGR17360

Name of Product

Lithium ion rechargeable cell (or, Lithium ion secondary cell)

(Model name)

CGR18650E / CGR17360

物質の特定 物質名 : リチウムイオン電池

C A S No. : 指定されない

国連分類 : リチウムイオン電池(UN3480)に分類されるが、2009IATA危険物規則書50版 包装規則965 パート1 が適用される。従って、リチウムイオン電池は下記要求を満たすことによって非危険物として取り扱われる。(1)

*リチウムイオン単電池の場合、Wh値が20Wh以下、かつ国連勧告安全性試験に合格した場合、国連分類上、危険物除外となる。(1)(2)
特別規程A154に該当するものは範囲外で、A164には適合する。(2)

主な材料の含有量 :

正極	; コバルト酸リチウム	20～35wt%
負極	; カーボン	10～20wt%
電解液	; 炭酸エステルを主とする有機電解液 (危険物第4類第2石油類)	10～20wt%

Substance Identification

Substance : Lithium ion rechargeable cell

CAS number : Not specified.

UN Class : Even classified as lithium ion batteries (UN3480), 2009IATA Dangerous Goods Regulations 50th edition Packing Instruction 965 Part 1 is applied. The product is handled as Non-Dangerous Goods by meeting the following requirements. (1)

Lithium ion cells offered for transport are not subject to the other additional requirements of the UN Regulations if they meet the following. (1)(2)

- The Watt-hour rating is not more than 20Wh.
- Each cell is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, sub-section 38.3

And they are out of scope for Special Provision A154 and comply with special Provision A164.(2)

Composition	: Positive electrode; Lithium cobalt oxide	20－35wt%
	Negative electrode; Carbon	10－20wt%
	Electrolyte; Organic electrolyte mainly composed of alkyl carbonate	10－20wt%

危険有害性の分類

分類の名称 : 該当しない

危険性 : 電池の正負極端子を金属片等で短絡させると発熱、液漏れのおそれがある。電解液が流出した場合は引火性があるので、直ちに火気より遠ざける。

有害性 : 電池が燃焼した場合、発生した蒸気は、目、皮膚、のどを刺激するおそれがある。

Hazardous and Toxicity Class

Class name	: Not applicable for regulated class
Hazard	: It may cause heat generation or electrolyte leakage if battery terminals contact with other metals. Electrolyte is flammable. In case of electrolyte leakage, move the battery from fire immediately.
Toxicity	: Vapor generated from burning batteries, may make eyes, skin and throat irritate.

応急処置

製品から電解液が漏液した場合の措置について以下記載する。

目に入った場合 : こすらずに、直ちに水道水で15分間以上洗った後に、医師の診断を受ける。放置すると目に障害を与えるおそれがある。

皮膚に付着した場合 : 石鹼を使用して水で十分に洗い流す。放置すると皮膚に炎症を引き起こすおそれがある。

吸引した場合 : 直ちに新鮮な空気のある場所に移動し安静を保ち、医者の診断を受ける。

First Aid Measures

The product contains organic electrolyte. In case of electrolyte leakage from the battery, actions described below are required.

Eye contact	: Flush the eyes with plenty of clean water for at least 15 minutes immediately, without rubbing. Take a medical treatment. If appropriate procedures are not taken, this may cause an eye irritation.
Skin contact	: Wash the contact areas off immediately with plenty of water and soap. If appropriate procedures are not taken, this may cause sores on the skin.
Inhalation	: Remove to fresh air immediately. Take a medical treatment.

火災時の措置

消火方法 : 燃焼時の蒸気は目、鼻、のどを刺激するおそれがあるので、消火作業は、風上から行い、場合によっては呼吸保護具を着用する。

消火剤 : 大量の水、泡消火薬剤が有効である。

Fire Fighting Measures

Extinguishing method : Since vapor, generated from burning batteries may make eyes, nose and throat irritate, be sure to extinguish the fire on the windward side. Wear the respiratory protection equipment in some cases.

Fire extinguishing agent : Plenty of water and alcohol-resistant foam are effective.

漏出時の措置（電解液が製品から漏出した場合）

- ・ 乾布で拭き取る。
- ・ 火気より遠ざける。

Measures for electrolyte leakage from the battery

- Take up with absorbent cloth.
 - Move the battery away from the fire.
-

取扱い及び保管上の注意

- ・ 電池の端子は外部ショートを防止するために、個々に仕切られた状態で梱包するか、又は個々にプラスチック袋に梱包する。(1)
- ・ 保管、輸送時には雨水などでぬらさない。
- ・ 電池を保存する場合は電池容量を30～50%にして、常温で保存することを推奨する。
- ・ 35℃以上の高温、直射日光、ストーブなどの熱源近く、多湿、結露、水滴、凍結下での保存は、避ける。
- ・ 通常の取り扱いで誤って梱包が破損しても、電池の端子間ショートが発生しない梱包方法とする。(1)
- ・ 電池パックに組み込まれている保護装置が損傷するような静電気の発生装置の近くは避ける。
- ・ 多量の電池を保管する場合は消防法の適応を受ける場合がある。(6)

Handling and Storage

- When packing the cells, do not allow battery terminals to contact each other, or contact with other metals. Be sure to pack batteries by providing partitions in the packaging box, or in a separate plastic bag so that the single batteries are not mixed together. (1)
 - Do not let water penetrate into packaging boxes during their storage and transportation.
 - The Cell will be stored at room temperature, charged to about 30—50% of capacity.
 - Do not store the cell in places of the high temperature exceeding 35 deg. C or under direct sunlight or in front of a stove. Please also avoid the places of high humidity. Be sure not to expose the cell to condensation, water drop or not to store it under frozen condition.
 - Cells are sure to be packed in such a way as to prevent short circuits under conditions normally encountered in transport. (1)
 - Please avoid storing the battery in the places where it is exposed to the static electricity so that no damage will not be caused to the protection circuit of the battery pack.
-

暴露防止措置 (電解液が製品から漏出した場合)

- 許容濃度 : 日本産業衛生学会, A C G I Hには規定されていない。(4)(5)
 設備対策 : 保管場所については局所排気装置を使用するなど、換気に注意する。
 保護具 : ガスマスク (有機ガス用), 保護眼鏡, 保護手袋

Exposure Control (in case of electrolyte leakage from the battery)

- Acceptable concentration : Not specified in ACGIH. (4)
 Facilities : Provide appropriate ventilation system such as local ventilator in the storage place.
 Protective clothing : Gas mask for organic gases, safety goggles, safety gloves.

物理／化学的性質

- 外観等 : 単電池は円筒形、又は角形
 公称電圧 : 単電池で 3.7 V

Physical and Chemical Properties

- Appearance : Single cell: Cylindrical or Prismatic cell
 Nominal voltage : Single cell: 3.7 volts

安定性及び反応性

電池は化学反応を利用した、いわゆる化学製品であり、使用した場合はもちろん、長期間の放置によっても性能劣化が生じる。また、実際の使用において充電、放電、温度などが適正条件に保たれない場合はサイクル寿命劣化や漏液による性能劣化、機器損傷の恐れがある。

Stability and Reactivity

Since batteries utilize a chemical reaction they are actually considered a chemical product. As such, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage.

有害性情報 (電解液が製品から漏出した場合)

急性毒性	: 経口 ラット LD50 >2g/kg (推定)
刺激性	: 皮膚, 目に刺激性あり。
変異原性	: 設定されていない。
慢性毒性	: 設定されていない。

Toxicological Information (in case of electrolyte leakage from the battery)

Acute toxicity	: Oral (rat) LD50 >2g/kg (estimated)
Irritation	: Irritating to eyes and skin.
Mutagenicity	: Not specified.
Chronic toxicity	: Not specified.

環境影響情報

- ・使用済み電池が土中に埋め立てられた場合、電池缶が腐食し内部の電解液が浸出してくることが考えられるが、環境影響への情報はない。
- ・単セル中の重金属
水銀 (Hg) およびカドミウム (Cd) は含まれていないし、用いてもいない。

Ecological Information

- In case of the worn-out cell was disposed in land, the cell case may be corroded, and leak electrolyte. But, we have no ecological information.
- Heavy metal in cell
Mercury(Hg) and Cadmium(Cd) are neither contained nor used in cell

廃棄上の注意 (リサイクル上の注意)

- ・廃棄電池であっても多量の保管は、消防法の適応を受ける場合がある。 (6)
- ・使用済み電池の廃棄は、法律ならびに各地方自治体の条例に従うこと。
- ・使用済み電池は、資源有効利用促進法の適応を受ける。

Disposal Considerations (Precautions for recycling)

- When the battery is worn out, dispose of it under the ordinance of each local government or the law issued by relating government.
- Disposal of the worn-out battery may be subjected to Collection and Recycling Regulation.

輸送上の注意(1),(2)

- ・ 製造者により安全上の理由で欠陥品と認められた、損傷して発熱、発火、短絡などの危険な状態を引き起こす恐れのあるリチウムイオン電池は輸送が禁止される。
(例えば、安全上の理由から製造者に返品されたリチウムイオン電池)
- ・ 航空機輸送は、機器に組み込まれている場合を除き、個数に関係なく 1 個以上の単電池、および組電池を含む包装物は、次の追加条件を満たさなければならない。(1)(2)
 1. 各積荷は以下の内容を明記したドキュメントを添付しなければならない。
 - ・ 包装物にリチウムイオン電池が収納されていること。
 - ・ 包装物が損傷を受けた場合、発火の危険があるため丁寧に取り扱いなくてはならないこと。
 - ・ 包装物が損傷を受けた場合に従うべき手順を記載したドキュメントの添付。
必要であれば、検査と再梱包も含まれる。
 - ・ 緊急連絡先電話番号。
 2. 各包装物にはリチウムバッテリーハンドリングラベルを添付しなければならない。
 - * 120mm×110mmのサイズのリチウムバッテリーハンドリングラベルを包装物の側面に折り曲げないで貼付すること。
 3. 各包装物はあらゆる向きでの1.2mの落下テストでの以下の項目に対する保証。
 - ・ 包装物内のリチウムイオン単電池及びリチウムイオン組電池の損傷の無いこと。
 - ・ 包装物内のリチウムイオン単電池及びリチウムイオン組電池が接触するような移動の無いこと。
 - ・ 包装物内の内容物が外に飛び出さないこと。
 4. 1梱包は10kg以下とする。
 5. 単電池5セル、組電池3パック以上が機器に組み込まれている場合は、上記1.及び2.が必要となる。
- ・ 船舶，トラック，鉄道による大量輸送の場合は、高温放置，結露等を避ける。
- ・ 荷崩れ，梱包破損の可能性のある輸送は避ける。
- ・ 組電池（複数のセルを組合せた電池）を輸送する際は国連勧告、IATA危険物規則書に従うこと。

Transport Information (1),(2)

- ・ Lithium ion batteries identified by manufacturer as being defective for safety reason, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport(e.g. those being returned to the manufacturer for safety reasons).

- Except when installed in equipment, for air shipment that contain one or more cells or batteries, they are necessary to meet the following items.
 1. Each consignment must be accompanied with a document such as air waybill with an indication that ;
 - the package contains lithium ion cells and batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary ; and
 - a telephone number for additional information.
 2. Each package must be labeled with a lithium battery handling label.
*The width 120mm * length 110mm sized lithium battery handling label must be labeled onto the side of a package without bending it.
 3. Each package must be capable of withstanding a 1.2m drop test in any orientation.
 - damage to cells or batteries contained therein;
 - shifting of the contents so as to allow battery to battery(or cell to cell) contact;
 - releaser of contents.
 4. Quantity per package shall not exceed 10kg.
 5. Each package containing more than five cells or more than three batteries installed in equipment must be complied with above item 1 and 2.

-During the transportation of a large amount of cells by ship, trailer or railway, do not leave them in the places of high temperatures and do not allow them to be exposed to condensation.

-During the transportation do not allow packages to be fallen down or damaged.

Transportation of Batteries (assembled over two cells) is subjected to
UN –Recommendations and IATA Dangerous Good Regulations.

適用法令

- ・ 消防法
- ・ 航空法
- ・ 船舶安全法
- ・ 資源有効利用促進法
- ・ IATA 危険物規則書50版

Regulatory Information

- IATA Dangerous Goods Regulations 50th Edition Effective 1 January 2009
- ICAO Technical Instructions for the safe transport of dangerous goods by air

その他

引用文献

- (1) UNITED NATIONS 危険物輸送専門家委員会勧告 (ST/SG/AC.10/1/Rev.12)
- (2) IATA 危険物規則書50版 (Effective 1 January 2009)
- (3) リチウム及びリチウムイオン電池の輸送に関する手引書第2版 社団法人 電池工業会
- (4) TLV s and BEI s 1999 ACGIH
- (5) 許容濃度提案理由書集(1962－1993年) 日本産業衛生学会編 H6.9.30第1版
- (6) 注解消防関係法規集 2002年新版

Others

References

- (1) UN Recommendations on the Transportation of Dangerous Goods Model Regulations
(ST/SG/AC.10/1/Rev.12)
 - (2) IATA Dangerous Goods Regulations 50th Edition Effective 1 January 2009
 - (3) Manual for Transport of Lithium/Lithium Ion Batteries 2nd Edition Battery Association of Japan
 - (4) TLV s and BEI s 1999 ACGIH
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Panasonic

Lithium Ion NCR18650A

Features & Benefits

- High energy density
- Long stable power and long run time
- Ideal for notebook PCs, boosters, portable devices, etc.

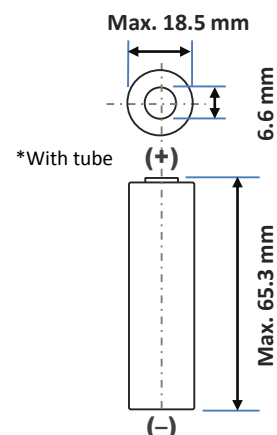
* At temperatures below 10°C, charge at a 0.25C rate.

Specifications

Rated capacity ⁽¹⁾	Min. 2900mAh
Capacity ⁽²⁾	Min. 2950mAh Typ. 3070mAh
Nominal voltage	3.6V
Charging	CC-CV, Std. 1475mA, 4.20V, 4.0 hrs
Weight (max.)	47.5 g
Temperature	Charge*: 0 to +45°C Discharge: -20 to +60°C Storage: -20 to +50°C
Energy density ⁽³⁾	Volumetric: 620 Wh/l Gravimetric: 225 Wh/kg

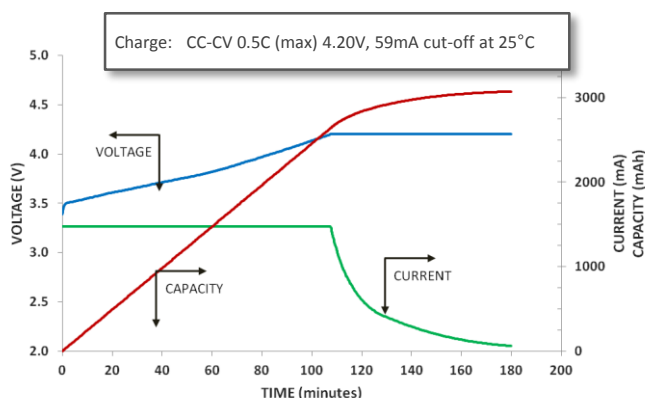
⁽¹⁾ At 20°C ⁽²⁾ At 25°C ⁽³⁾ Energy density based on bare cell dimensions

Dimensions

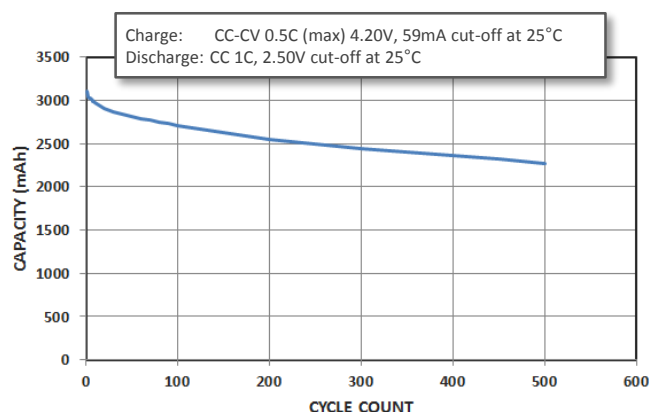


For Reference Only

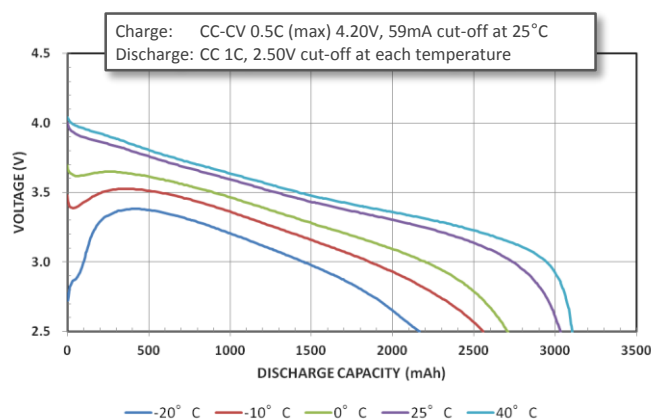
Charge Characteristics



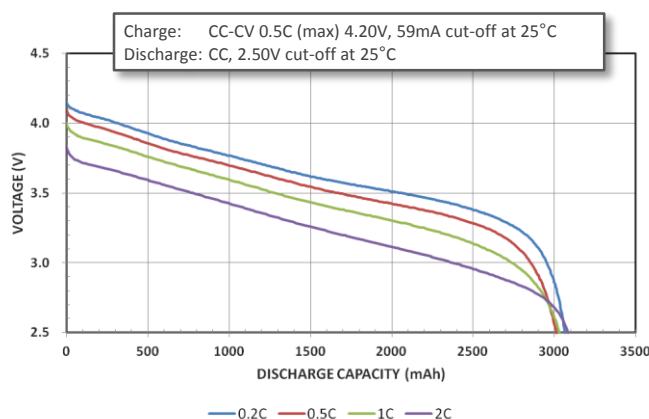
Cycle Life Characteristics



Discharge Characteristics (by temperature)



Discharge Characteristics (by rate of discharge)



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