TOSHIBA

Leading Innovation

技術カタログ

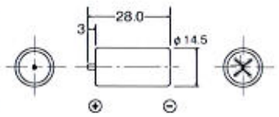
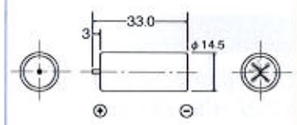
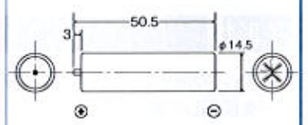
東芝塩化チオニルリチウム電池

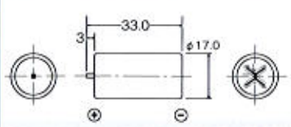
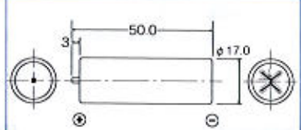
THIONYL CHLORIDE LITHIUM BATTERY TECHNICAL CATALOG

OVERVIEW

- Thionyl Chloride Lithium Battery (ER series) uses highly active thionyl chloride ($SOCl_2$) for the positive electrode reactant, and lithium for the negative electrode reactant. The voltage is the highest among lithium primary batteries at 3.6V, and the electric energy in a AA size is 7000mWh, realizing high energy.
- Self-discharge is minimized by using highly pure materials. The battery can be used in a wide range of temperatures (-55℃ to +85℃) and is highly reliable, as fluid leakage is not a concern due to the use of Laser Weld Sealing for complete enclosure.
  The product is especially suited for long term use, such as memory backup power supply, and as the power for electricity/gas/water meters (Please contact us when using for extended periods of time in high temperature or low temperature conditions).
- Our Thionyl Chloride Lithium Battery is a UL (safety standard) certified part, and its safety and reliability have been proven (Certification Number: MH12828).

Rated Value

Model No.	ER3V	ER4V	ER6V
Nominal Voltage (V)	3.6	3.6	3.6
Nominal Capacity (mAh)*1	1000	1200	2000
Dimensions (mm)*2			
Maximum Discharge Current (mA)	1.0	1.0	3.5
Weight (g) *3	8.5	10	16
Usable Temperature Range	-55℃ to +85℃		

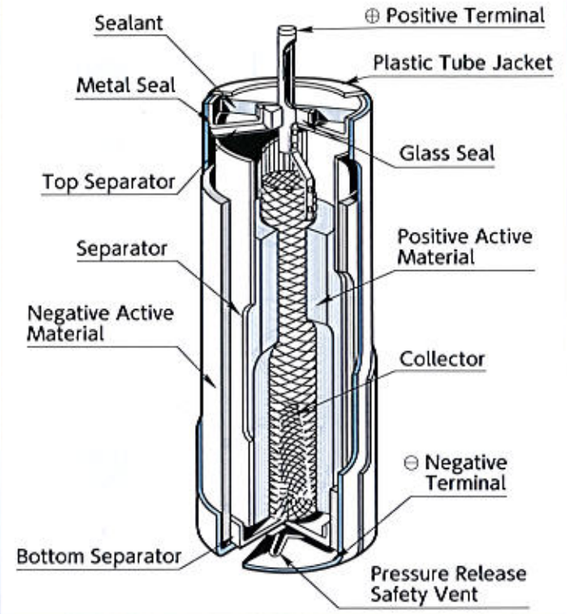
Model No.	ER17330V	ER17500V
Nominal Voltage (V)	3.6	3.6
Nominal Capacity (mAh)*1	1700	2700
Dimensions (mm)*2		
Maximum Discharge Current (mA)	1.0	3.5
Weight (g) *3	13	19
Usable Temperature Range	-55℃ to +85℃	

*1: Nominal capacity is figured out of the duration until the voltage drop down to 2.5V when discharged at a Maximum Discharge Current at 20℃
*2: Data and Dimensions are reference levels
*3: The above weight information are limited to battery itself. Actual product weight depends on the final specifications

FEATURES

- High Voltage
  The voltage is the highest among lithium primary batteries at 3.6V, and one unit can take the place of 2 to 3 batteries which were needed in the past.
- High Energy Density
  High energy density of approximately 1000mWh/cm³ is realized by the use of a special carbon cathode body in addition to a highly active positive electrode reactant (thionyl chloride).
- Excellent Discharge Characteristics
  The battery is designed for small changes in internal resistance during discharge, delivering stable operational voltage even with the progressing depth of discharge.
- Wide Range of Operating Temperature
  Unlike batteries of the past, the battery can be used in a wide range of temperatures (-55°C to +85°C).
  (Please contact us when using for extended periods of time in high temperature or low temperature conditions).
- Long Term Reliability
  The battery is highly reliable in the long term due to a structural design which allows very small self-discharge and due to the adoption of Laser Sealing which encloses completely.

Structure of ER6V



TERMINAL SHAPE

- ER series terminals are offered in types for soldering directly onto the circuit board, for using connectors allowing detachment, and with lead wire.

Type	Type Code	Attachment to Board + Terminal	Attachment to Board − Terminal	Pitch Dimensions by Battery (mm) ER3V	ER4V	ER6V	ER17330V	ER17500V
Board Mounting	T1	1 line	1 line	25.5	30.5	49.0	31.0	49.0
	T2	1 line	2 lines	25.5	30.5	49.0	31.0	49.0
	P	1 line	1 line	30.5	35.5	53.0	36.0	53.0
With Connector	C	Connector		Please contact us for details				
Without Connector	LY	Lead Wire						

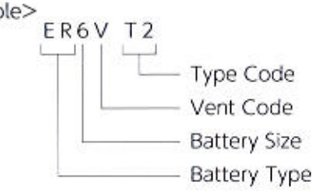
SAFETY VALVE

- To improve safety, all Thionyl Chloride Lithium Batteries are equipped with safety valves. Thionyl Chloride Lithium Batteries adopt Laser Weld Sealing and Glass Seal for complete enclosure in order to secure long term reliability. When the battery is mishandled, such as by charging or by placing in fires, this structure may cause a rapid increase of internal pressure and heat expansion of the battery which may cause violent explosion. Safety Valves are installed on all batteries to improve safety by preventing these accidental dangers.

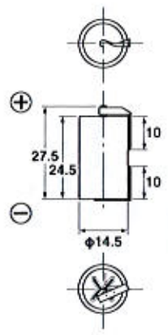
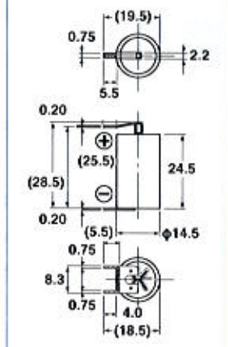
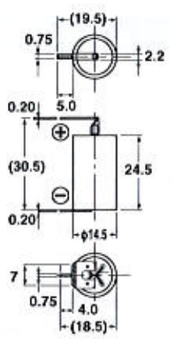
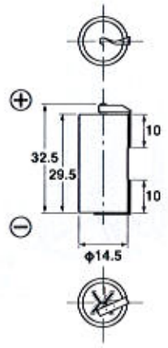
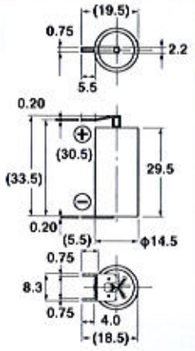
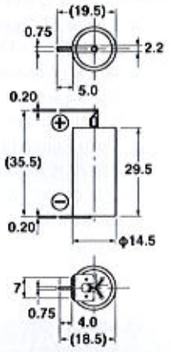
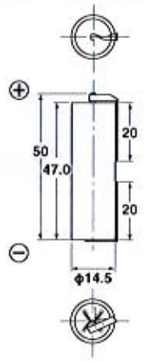
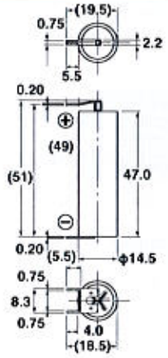
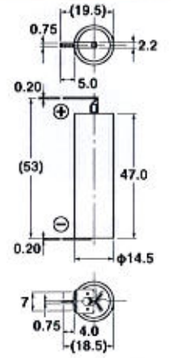
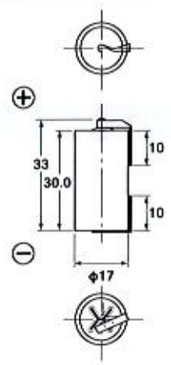
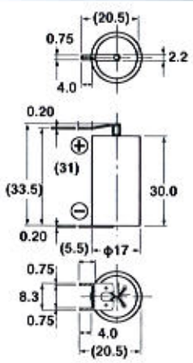
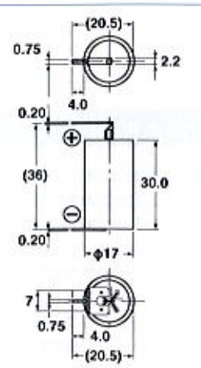
PRODUCT NAME

- Major product names are listed below ;

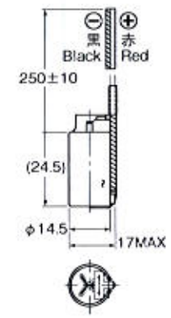
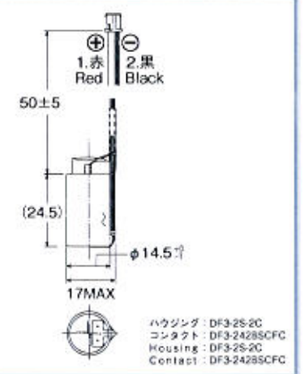
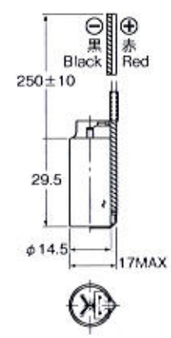
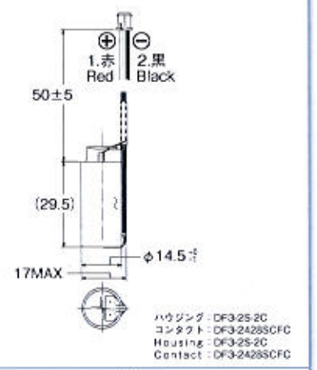
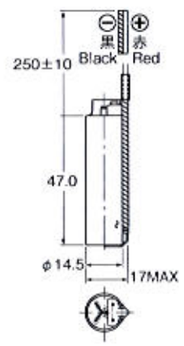
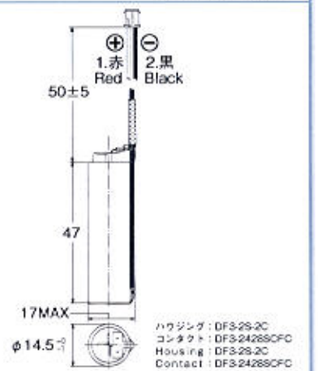
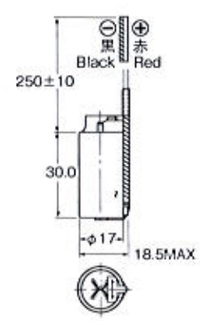
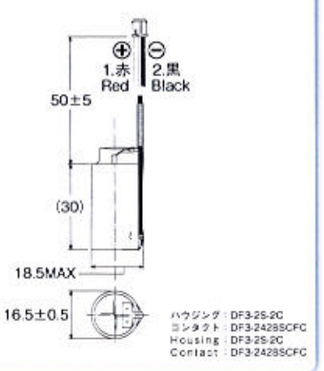
<For Example>



■ 形状と寸法図（標準仕様） | Overall Dimensions（Standard Specifications）

品番 | Model	形状(mm) | Shape(mm)	品番 | Model	形状(mm) | Shape(mm)	品番 | Model	形状(mm) | Shape(mm)
 ER3V T1		 ER3V T2		 ER3V P	
 ER4V T1		 ER4V T2		 ER4V P	
 ER6V T1		 ER6V T2		 ER6V P	
 ER17330V T1		 ER17330V T2		 ER17330V P	

■ 形状と寸法図（標準仕様） | Overall Dimensions（Standard Specifications）

品番 | Model	形状 (mm) | Shape (mm)	品番 | Model	形状 (mm) | Shape (mm)
 ER3V LY		 ER3V C1	
 ER4V LY		 ER4V C1	
 ER6V LY		 ER6V C1	
 ER17330V LY		 ER17330V C1	

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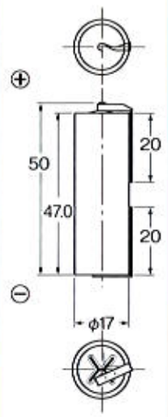
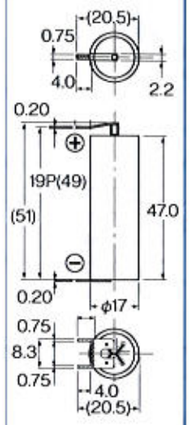
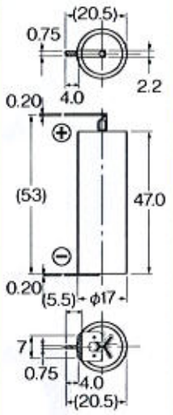
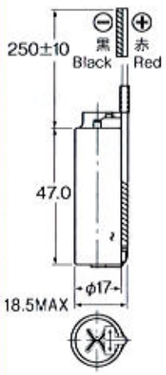
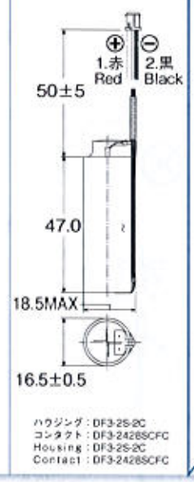
					
ER17500V T1		ER17500V T2		ER17500V P	
					
ER17500V LY		ER17500V C1			

ハウジング：DF3-2S-2C
コンタクト：DF3-2428SCFC
Housing：DF3-2S-2C
Contact：DF3-2428SCFC

◆ 安全認証

弊社塩化チオニルリチウム電池は、UL（Underwriter Laboratories Inc.）の部品認定を取得しており（テクニカル・リプレースメント）、さらに、ULの実施するフォローアップサービス・プログラムに従い検査を受けた工場で製造されています。

認可番号： MH12828

ULとは、米国最大の独立安全性機関であり、機器、材料、部品などに対して安全性の見地から調査、試験を行い認定を行うとともに、UL規格を作成、発行しています。

◆ Safety Certification

Our Thionyl Chloride Lithium Batteries are UL (Underwriter Laboratories Inc.) certified parts (technical replacements), and are manufactured in inspected factories that conform to the follow up service program conducted by UL.

Certification Number： MH12828

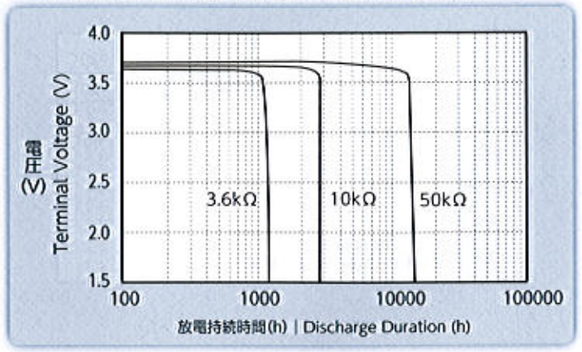
UL is the largest independent safety organization in the U.S. that conducts investigations and tests on instruments, materials, and parts from a safety perspective, and provides certifications along with the formulating and introducing UL standards.

ER3V 標準特性 | ER3V STANDARD CHARACTERISTICS

■ 放電特性 放電条件： 定抵抗連続放電、初度、20℃

Discharge Characteristics

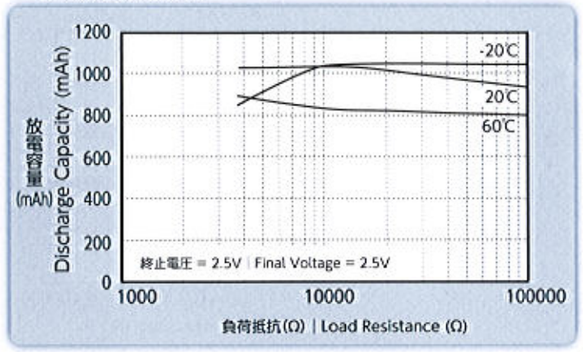
Discharge - Conditions： Continuous Discharge with Fixed Resistance, Initial, 20℃



■ 負荷抵抗 — 放電容量 初度、連続放電

Load Resistance - Discharge Capacity

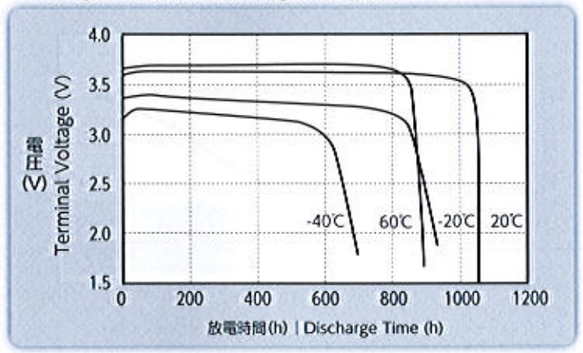
Initial, Continuous Discharge



■ 放電温度特性 放電条件： 3.6kΩ連続放電、初度

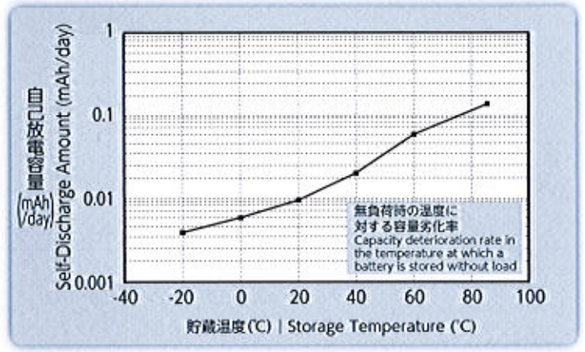
Discharge Temperature Characteristics

Discharge - Conditions： Continuous Discharge with 3.6kΩ, Initial



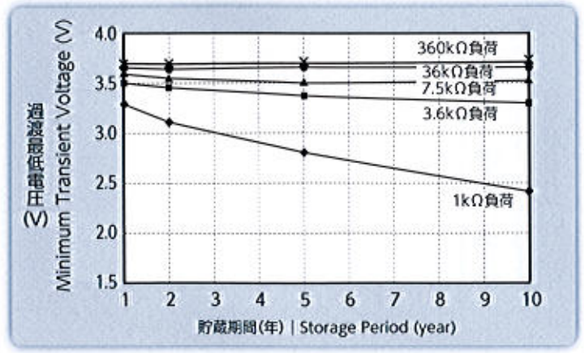
■ 自己放電特性（無負荷貯蔵）

Self - Discharge Characteristics (Storage without Load)



■ 貯蔵品 VD特性

Stored Product - VD Characteristics

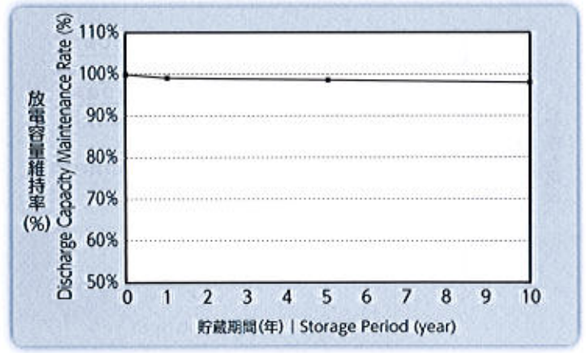


貯蔵条件：
未使用電池を製造後20℃にて、無負荷で貯蔵
測定条件：
貯蔵後の電池に各負荷をかけ放電し、放電開始直後のVoltage Delayによる電圧低下の最低値を測定
温度： 20℃
・VD特性は貯蔵条件で大きく変わり、電池個々のバラつきあり
・この資料は実験の結果であり、グラフの範囲での放電を保証するものではない

- Storage Condition：
  After manufacturing, store unused battery without load at 20℃
- Measurement Condition：
  Apply each of the loads to the battery after storage to discharge, and measure the minimum value of voltage reduction caused by Voltage Delay immediately after the start of discharge
- Temperature： 20℃
  - VD Characteristics change largely according to storage conditions. Variances between individual batteries also exist.
  - This information is based on the results of experiments and does not guarantee Discharge Characteristics within the graphed region.

■ 貯蔵後放電特性 測定結果

Measurement Results of Discharge Characteristics after Storage

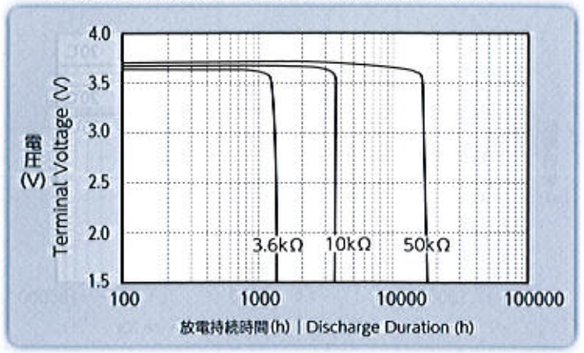


貯蔵条件： 20℃
放電条件： 3.6kΩ連続放電、2.5V cut - off, 20℃
＊キープサンプルの測定データ
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

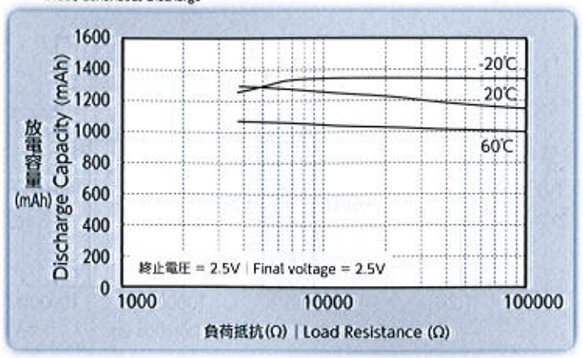
- Storage Condition： 20℃
- Discharge Conditions： Continuous discharge with 3.6kΩ, 2.5V cut - off, and 20℃
- ＊Measured data of key sample.
  Average Discharge Capacity from standard tests.
  Discharge Capacity changes according to test conditions.

ER4V 標準特性 | ER4V STANDARD CHARACTERISTICS

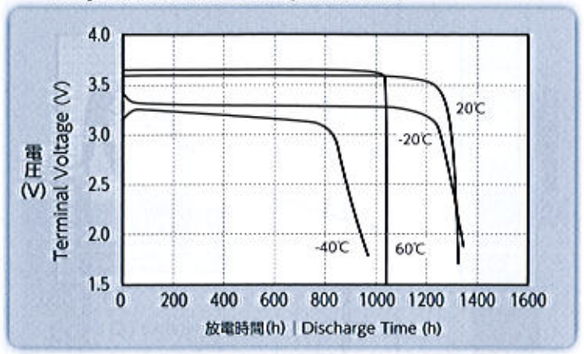
放電特性 放電条件： 定抵抗連続放電、初度、20℃
Discharge Characteristics
Discharge - Conditions : Continuous Discharge with Fixed Resistance, Initial, 20℃



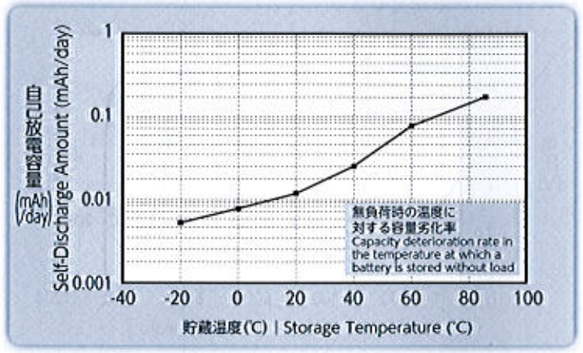
負荷抵抗 — 放電容量 初度、連続放電
Load Resistance - Discharge Capacity
Initial, Continuous Discharge



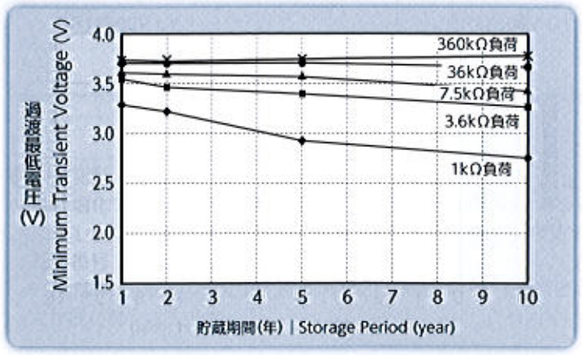
放電温度特性 放電条件： 3.6kΩ連続放電、初度
Discharge Temperature Characteristics
Discharge - Conditions : Continuous Discharge with 3.6kΩ, Initial



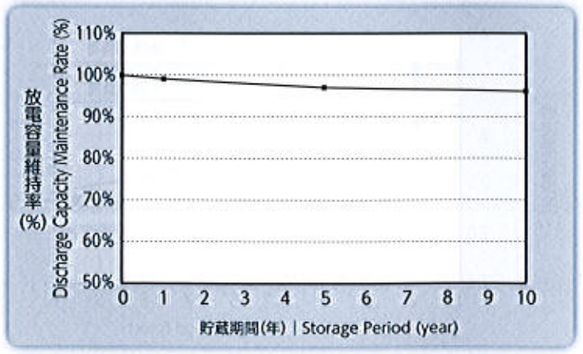
自己放電特性 （無負荷貯蔵）
Self - Discharge Characteristics (Storage without Load)



貯蔵品 VD特性
Stored Product - VD Characteristics



貯蔵後放電特性 測定結果
Measurement Results of Discharge Characteristics after Storage



貯蔵条件：
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測定条件：
貯蔵後の電池に各負荷をかけ放電し、放電開始直後のVoltage Delayによる電圧低下の最低値を測定
温度： 20℃
・VD特性は貯蔵条件で大きく変わり、電池個々のバラつきあり
・この資料は実験の結果であり、グラフの範囲での放電を保証するものではない

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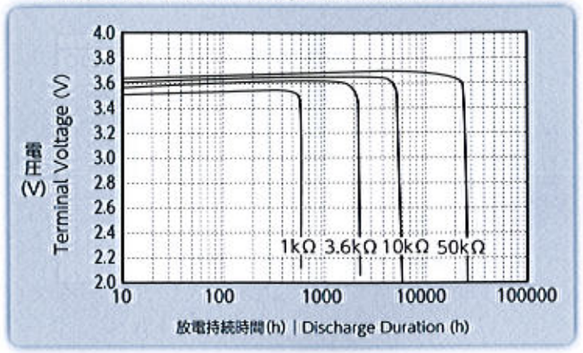
  - VD Characteristics change largely according to storage conditions. Variances between individual batteries also exist.
  - This information is based on the results of experiments and does not guarantee Discharge Characteristics within the graphed region.

貯蔵条件： 20℃
放電条件： 3.6kΩ連続放電、2.5V cut - off、20℃
＊キープサンプルの測定データ
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

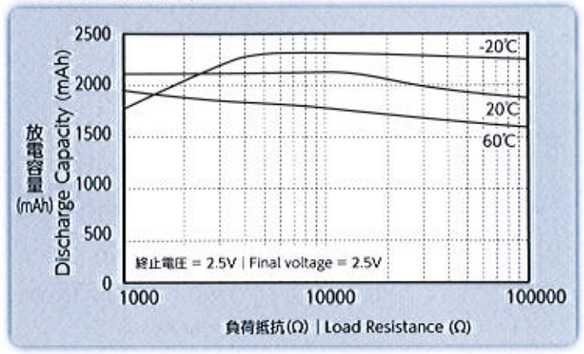
- Storage Condition : 20℃
- Discharge Conditions : Continuous discharge with 3.6kΩ, 2.5V cut - off, and 20℃
- Measured data of key sample.
  Average Discharge Capacity from standard tests.
  Discharge Capacity changes according to test conditions.

ER6V 標準特性 | ER6V STANDARD CHARACTERISTICS

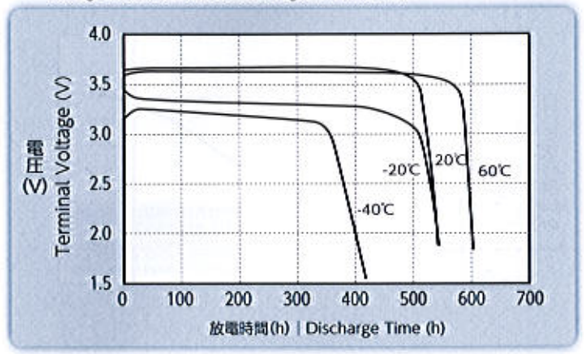
放電特性 放電条件： 定抵抗連続放電、初度、20℃
Discharge Characteristics
Discharge - Conditions : Continuous Discharge with Fixed Resistance, Initial, 20℃



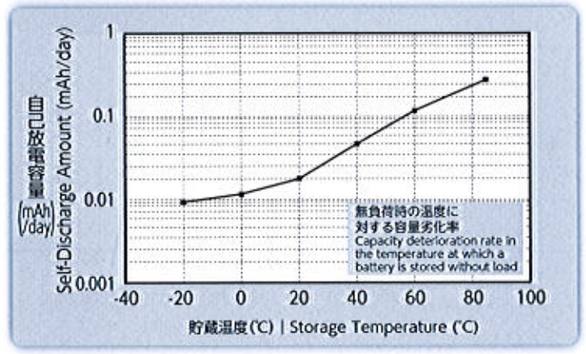
負荷抵抗 — 放電容量 初度、連続放電
Load Resistance - Discharge Capacity
Initial, Continuous Discharge



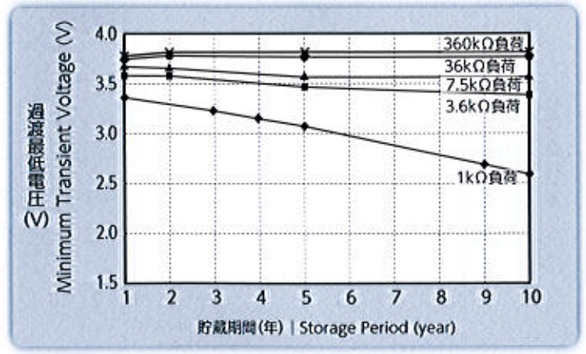
放電温度特性 放電条件： 3.6kΩ連続放電、初度
Discharge Temperature Characteristics
Discharge - Conditions : Continuous Discharge with 3.6kΩ, Initial



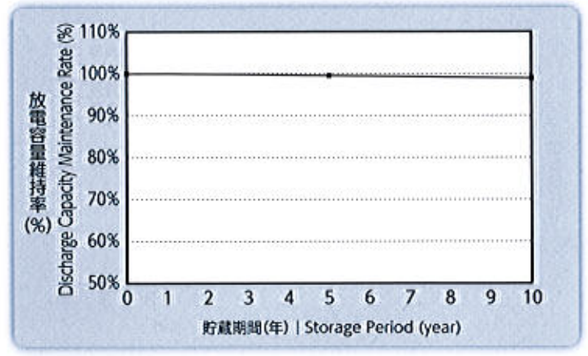
自己放電特性 （無負荷貯蔵）
Self - Discharge Characteristics (Storage without Load)



貯蔵品 VD特性
Stored Product - VD Characteristics



貯蔵後放電特性 測定結果
Measurement Results of Discharge Characteristics after Storage



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- Measurement Condition :
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- Temperature : 20℃
  - VD Characteristics change largely according to storage conditions. Variances between individual batteries also exist.
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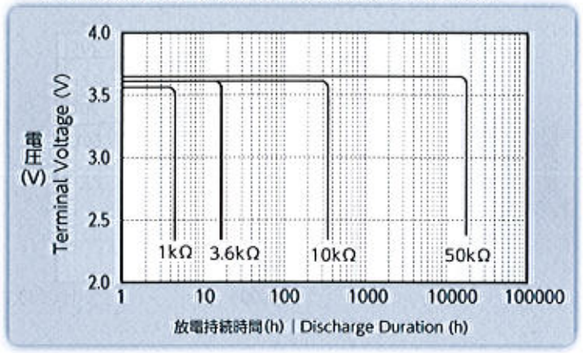
貯蔵条件： 20℃
放電条件： 1kΩ連続放電、2.5V cut - off、20℃
＊キープサンプルの測定データ
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

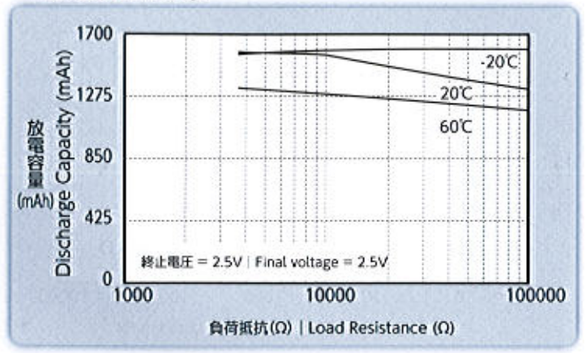
- Storage Condition : 20℃
- Discharge Conditions : Continuous discharge with 1kΩ, 2.5V cut - off, and 20℃
- Measured data of key sample.
  Average Discharge Capacity from standard tests.
  Discharge Capacity changes according to test conditions.

ER17330V 標準特性 | ER17330V STANDARD CHARACTERISTICS

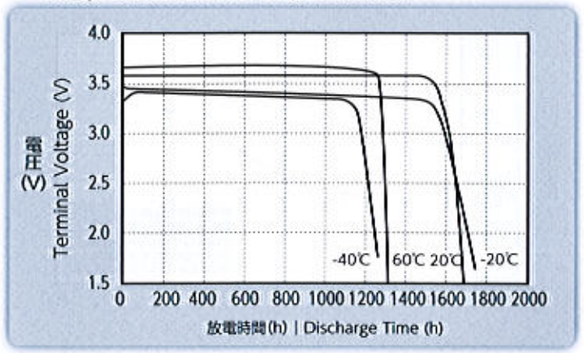
放電特性 放電条件： 定抵抗連続放電、初度、20℃
Discharge Characteristics
Discharge - Conditions : Continuous Discharge with Fixed Resistance, Initial, 20℃



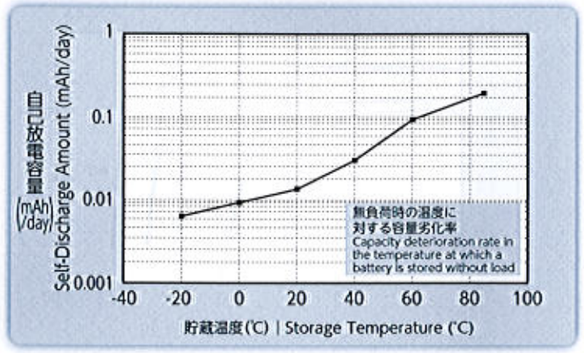
負荷抵抗 — 放電容量 初度、連続放電
Load Resistance - Discharge Capacity
Initial, Continuous Discharge



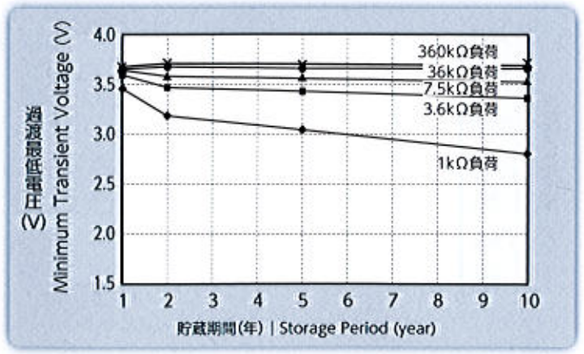
放電温度特性 放電条件： 3.6kΩ連続放電、初度
Discharge Temperature Characteristics
Discharge - Conditions : Continuous Discharge with 3.6kΩ, Initial



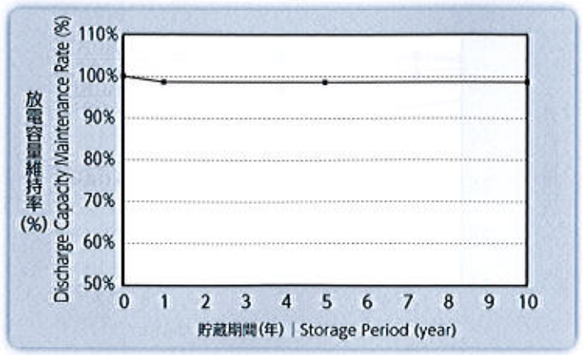
自己放電特性 (無負荷貯蔵)
Self - Discharge Characteristics (Storage without Load)



貯蔵品 VD特性
Stored Product - VD Characteristics



貯蔵後放電特性 測定結果
Measurement Results of Discharge Characteristics after Storage



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放電条件： 1kΩ連続放電, 2.5V cut - off, 20℃
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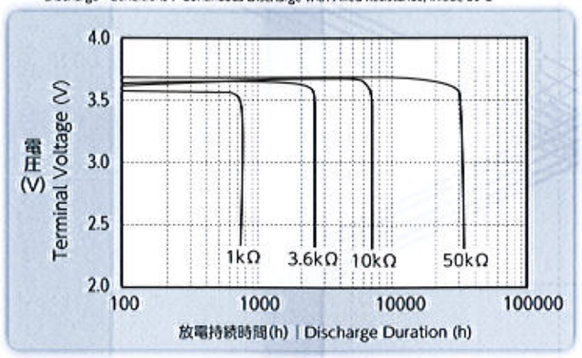
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

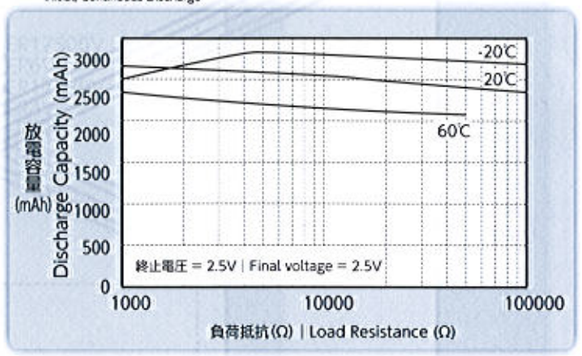
- Storage Condition : 20℃
- Discharge Conditions : Continuous discharge with 1kΩ, 2.5V cut - off, and 20℃
- Measured data of key sample.
  Average Discharge Capacity from standard tests.
  Discharge Capacity changes according to test conditions.

ER17500V 標準特性 | ER17500V STANDARD CHARACTERISTICS

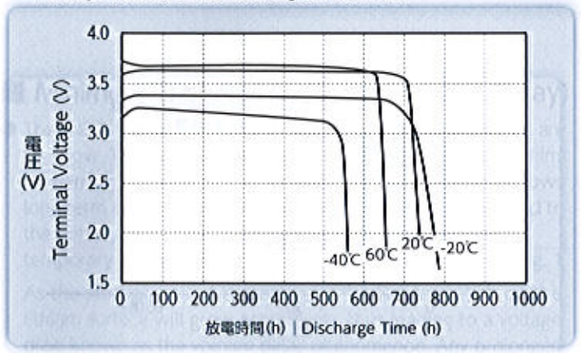
放電特性 放電条件： 定抵抗連続放電、初度、20℃
Discharge Characteristics
Discharge - Conditions : Continuous Discharge with Fixed Resistance, Initial, 20℃



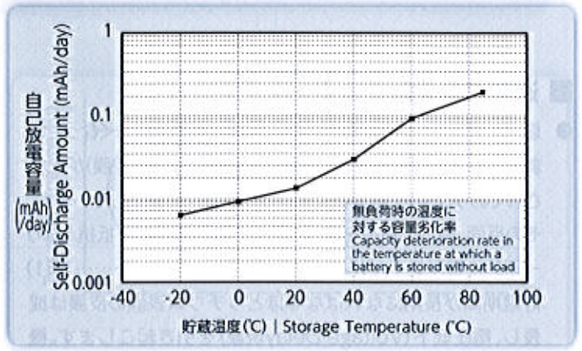
負荷抵抗 — 放電容量 初度、連続放電
Load Resistance - Discharge Capacity
Initial, Continuous Discharge



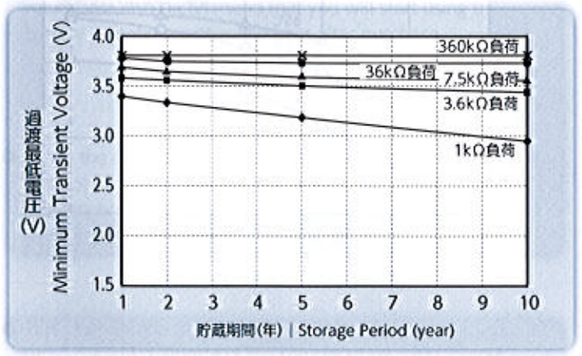
放電温度特性 放電条件： 3.6kΩ連続放電、初度
Discharge Temperature Characteristics
Discharge - Conditions : Continuous Discharge with 3.6kΩ, Initial



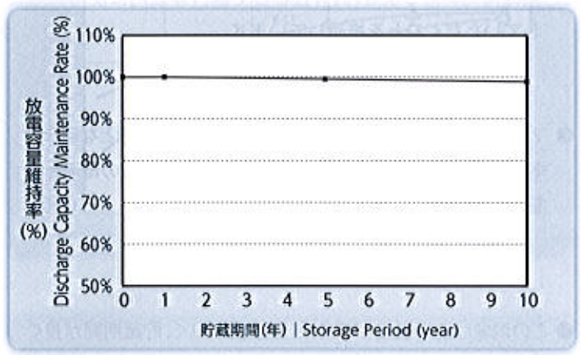
自己放電特性 (無負荷貯蔵)
Self - Discharge Characteristics (Storage without Load)



貯蔵品 VD特性
Stored Product - VD Characteristics



貯蔵後放電特性 測定結果
Measurement Results of Discharge Characteristics after Storage



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＊ キープサンプルの測定データ
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

- Storage Condition : 20℃
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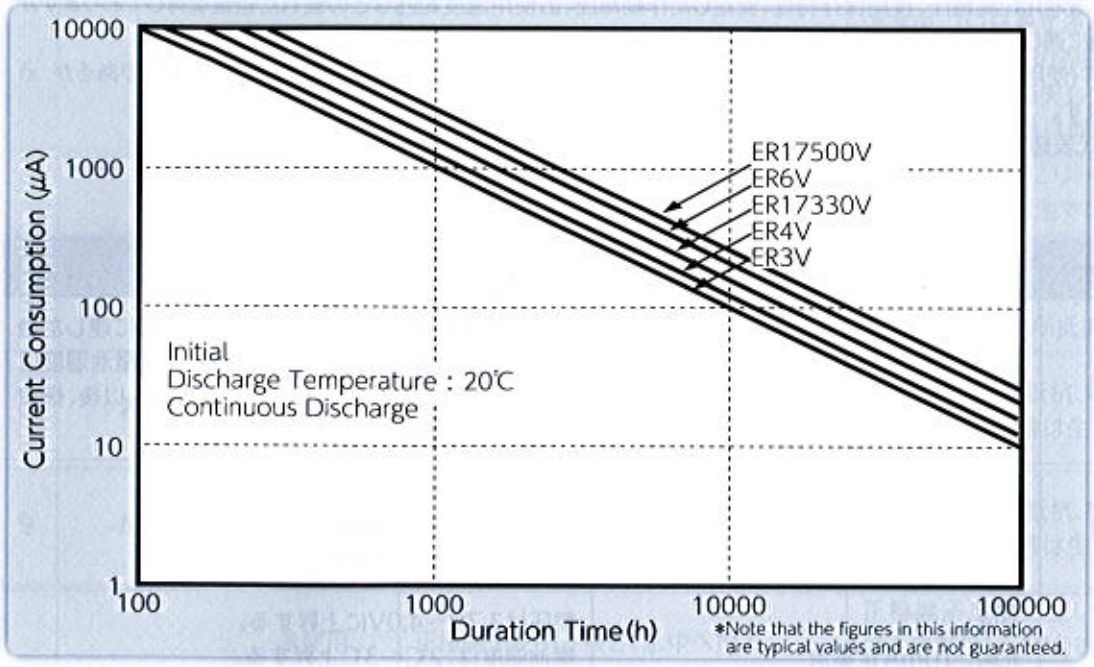
- Measured data of key sample.
  Average Discharge Capacity from standard tests.
  Discharge Capacity changes according to test conditions.

Discharge Characteristics



Minimum Transient Voltage (Voltage Delay)

- The self-discharge amount of Thionyl Chloride Lithium Batteries are very low. This is due to the passive film (lithium chloride film) formed on the surface of the negative electrode which allows long term storage. On the other hand, when load is applied to the battery, this passive film acts as resistance, creating a temporary voltage drop. ····· Fig. 1

  As the storage period is prolonged, the film formation on the lithium surface will grow accordingly, thus leading to a voltage drop known as the voltage delay phenomenon. Any prolonged storage should be avoided because such a voltage drop might cause malfunction, although the situation varies depends on device usage conditions (such as the environment and current value). We also recommend that you will start using the battery sometime within one year after purchase.

- When the current is in the micro-ampere order, the voltage drop will not create problems, but when the current is over a few milli-amperes, the voltage drop becomes noticeable. ····· Fig. 2

- This phenomena occurs more prominently at lower use temperatures, higher storage temperatures, and longer storage periods. ····· Fig. 2, Fig. 3

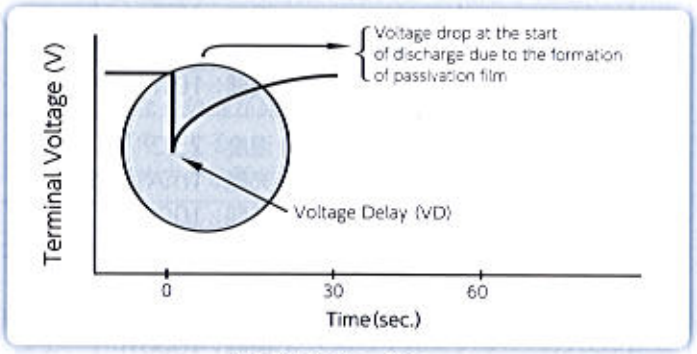


Fig. 1 Voltage Delay

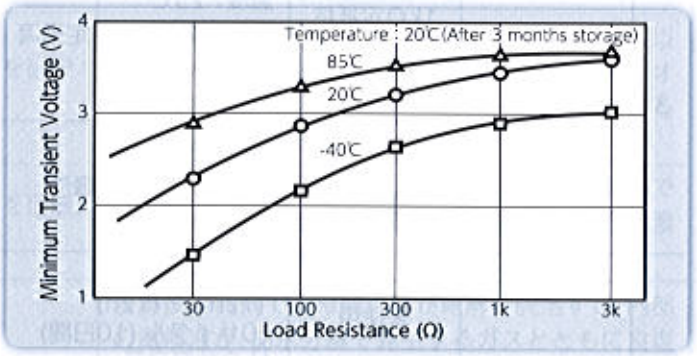


Fig. 2 Voltage Delay - Load Resistance

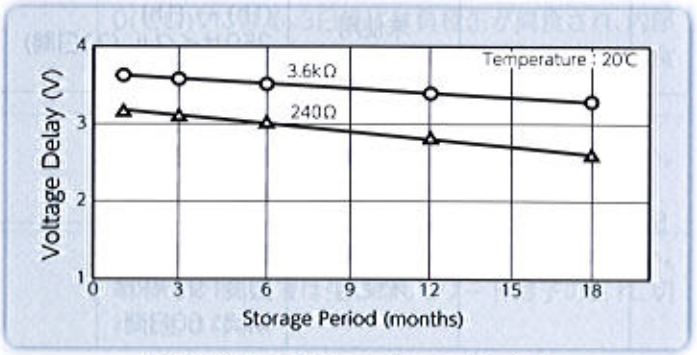


Fig. 3 Voltage Delay - Storage Period

Use of Toshiba Thionyl Chloride Lithium Batteries

Thionyl Chloride Lithium Batteries (ER batteries) offer excellent features such as high-voltage, long-term preservation property, stable operating voltage, and wide operating temperature range. However, these features are made possible only when the battery is used under a suitable condition.

Be sure to notify Toshiba of the use condition, e.g. ambient temperature, discharge specifications, and final voltage before designing a device to confirm that it is suitable for the use of ER batteries.

*Note that the figures in this information are typical values and are not guaranteed. They are for reference only.

ER6V Reliability Test

No.	Item	Battery Under Test	Test Conditions	Result
1	Short Circuit	Unused	Temperature: 25℃ External Short	The current reaches the peak of 1.6A immediately after shorting. The current then decreases and reaches 100mA, 30 minutes later. The battery temperature reaches the peak of 60℃ to 70℃ in 3 to 4 minutes. The temperature gradually declines through radiational cooling. Battery does not deform or leak fluid.
2	Charging	Unused	Temperature: 25℃ Charging: 1mA constant current Time: 1000h	Voltage increases to 3.7V to 3.8V. Battery temperature does not rise. Battery does not deform or leak fluid.
		Unused	Temperature: 25℃ Charging: 10mA constant current Time: 100h	Voltage increases to 3.7V to 4.0V. Battery temperature rises by 2℃ to 3℃. Battery does not deform or leak fluid.
		Unused	Temperature: 25℃ Charging: 100mA constant current Time: 10h	Voltage increases to 4.0V to 5.0V. Battery temperature rises to 35℃ one hour later. Battery does not deform or leak fluid.
		1kΩ fixed resistance after discharged (300h)	Temperature: 25℃ Charging: 1mA constant current Time: 1000h	Voltage increases to 3.7V to 3.8V. Battery temperature does not rise. Battery does not deform or leak fluid.
		1kΩ fixed resistance after completely discharged	Temperature: 25℃ Charging: 1mA constant current Time: 1000h	Voltage increases to 3.6V to 3.7V. Battery temperature does not rise. Battery does not deform or leak fluid.
3	Over Discharging	1kΩ fixed resistance after completely discharged	Temperature: 25℃ Discharging: 100mA constant current Time: 10h	Voltage reverses to 0V to -5.0V. Battery temperature rises to 33℃ at reversed state. The temperature then decreases and stabilizes at 27℃ to 30℃. Battery does not deform or leak fluid.
		1kΩ fixed resistance after completely discharged	Temperature: 25℃ Discharging: 1mA constant current Time: 1000h	Voltage becomes 0V to -0.1V. Battery does not deform or leak fluid.
4	Thermal Shock	Unused	-54℃ → 71℃ (12h) ← (12h) 10 cycles (10 day duration) 1kΩ discharge capacity	Open circuit voltage rises from 3.68V to 3.75V, and internal resistance increases. Irregularity is not found in the 1kΩ discharging test after the examination. Battery does not deform or leak fluid.
		Unused	-55℃ → 85℃ (1h) ← (1h) 250 cycles (21 day duration) 1kΩ discharge capacity	Open circuit voltage rises from 3.68V to 3.77V, and internal resistance increases. Irregularity is not found in the 1kΩ discharging test after the examination. Battery does not deform or leak fluid.
5	High Temperature with Humidification	Unused	Temperature: 45℃ Humidity: 93%RH Duration: 60 days	Open circuit voltage rises from 3.68V to 3.71V, and internal resistance increases. Battery does not deform or leak fluid. Rust partly begins to develop on the positive terminal due to condensation.
		Unused	Temperature: 60℃ Humidity: 93%RH Duration: 60 days	Open circuit voltage rises from 3.68V to 3.75V, and internal resistance increases. Battery does not deform or leak fluid. Rust begins to develop on the positive terminal due to condensation.
6	Water Immersion	Unused	Temperature: 25℃ Immersion: Tap water Duration: 14 days	3 days after immersion, electrolyte elutes from the positive terminal and gas is generated along with a large quantity of red rust. After two weeks, the positive terminal completely disappears. Gas is generated internally and sulfur is deposited. Water acidification occurs.
7	Vertical Fall	Unused	Drop with the positive terminal facing down, from the height of 1.5 meter to a flat concrete ground.	Leakage occurs in 10 out of 100 units. Open circuit voltage and internal resistance do not change in batteries without leakage.
		Unused	Drop 3 times with the battery bottom section facing down, from the height of 1.0 meter to a flat concrete ground.	Irregularity in external structure (either fluid leakage nor dislocated top) is not found, and changes in the open circuit voltage and internal resistance do not occur.
8	Depressurization	Unused	Temperature: 25℃ Depressurization: 1.33kPa Time: 50h	Changes are not observed in the open circuit voltage, internal resistance, and battery mass. Battery does not deform or leak fluid.
9	Pressurization	Unused	Temperature: 25℃ Depressurization: 405.3kPa Time: 12h	Changes are not observed in the open circuit voltage, internal resistance, and battery mass. Battery does not deform or leak fluid.
10	Perforation Under Water Immersion	Unused	Pull out the positive terminal and immerse into water	Bubbles emerge from the hole caused by the missing positive terminal, but the bubbles gradually decrease and stop after 10 minutes. Sulfur deposits and water acidification occurs.
		1kΩ fixed resistance after completely discharged	Pull out the positive terminal and immerse into water	Bubbles emerge from the hole caused by the missing positive terminal, but the bubbles gradually decrease and stop after 15 minutes. Water acidification occurs.
		Unused	Perforate a hole sized ϕ2mm at the bottom of the can and immerse into water	Bubbles emerge from the hole, but the bubbles gradually decrease and stop after 15 minutes. Sulfur deposits and water acidification occurs.
		1kΩ fixed resistance after completely discharged	Perforate a hole sized ϕ2mm at the bottom of the can and immerse into water	Bubbles emerge from the hole, but the bubbles gradually decrease and stop after 15 minutes. Water acidification occurs.
		Unused	Remove the cap and immerse into water at fully open state	Bubbles emerge intensely from the hole in the can, but the bubbles gradually decrease and stop after 5 minutes. Sulfur deposits and water acidification occurs.
11	Glass Seal Rupture	Unused	Hammer on the positive terminal and rupture the Glass Seal Temperature: 25℃	One hour after rupture, loss of mass amounting to 2mg is observed, but noticeable change in mass is not found thereafter. Assuming that the leaked thionyl chloride was diffused in a room with floor area of 60m², this would be around 2ppb.
		1kΩ fixed resistance after completely discharged	Amount of SO_2 due to $BaSO_4$ deposition after damaging the Glass Seal by hammering the positive terminal	SO_2 per battery is 110mol, approximately 280ml is generated at 25℃ / 101.3kPa. In a room with floor area of 60m², SO_2 density is 2.7ppb.
12	Saline Solution Immersion	Unused	Temperature: 25℃ Immersion: 5% saline solution Duration: 14 days	4 hours after immersion, the positive terminal electrolyzes and falls off. The internal electrolyte leaks along with the gas generated from hydrolysis into the saline solution, and acidification occurs. Gas generation ceases almost entirely in 15 hours, and the voltage becomes 0 (zero) volts in 48 hours. 3 days later, the negative terminal corrodes, and the internal lithium and electrolyte were both depleted. Thereafter, the corrosion of the can proceeds, but gas is not generated.
13	Vibration	Unused	Vibration Frequency: 35Hz Full Amplitude: 2mm Time: 2h x 3 (X, Y, Z)	Changes are not observed in the open circuit voltage, internal resistance, and battery mass. Battery does not deform or leak fluid.
		Unused: Solder battery with terminal onto the PC board	Vibration Frequency: 35Hz Full Amplitude: 2mm Time: 2h x 3 (X, Y, Z)	Changes are not observed in the open circuit voltage, internal resistance, and battery mass. Battery does not deform or leak fluid. Dislocation or rupture of the lead terminal do not occur.

* Typical values listed on this information are not guaranteed, and the specifications are subject to change without notice.

Precautions for using Thionyl Chloride Lithium Batteries

1. Precautions for designing instruments which use the battery

Mishandling this battery may cause leakage, heating, explosion, and ignition, so please follow the precautions listed below.

(1) Precautions for designing the battery compartment

① Please design the battery compartment to allow for easy battery replacement and difficult to detach secured mounting.

② In order to prevent swallowing or injury, please design the mounting method of the battery compartment cover in such a way that small children cannot easily remove or access the battery. At the same time, please provide a caution notice stating "Please do not leave the battery where small children can access it" to everybody through methods such as placing it in the users manual.

③ When designing the battery compartment and the contact dimensions and shape, in order to prevent contact failures and reverse mounting, please consider the dimensions and the tolerances of the battery and its positive (+) and negative (-) terminals. The battery compartment dimensions should be designed to match the product dimension diagram defined for the battery.

④ In the battery compartment, please clearly indicate the battery type to be used in the instrument and the correct battery mounting position (polarity). When the area for indication is not available, please clearly note this in the users manual.

⑤ The electrical circuit within the battery compartment should be only contact related and should be independent from the other electrical circuits.

⑥ To minimize damage to the instrument due to fluid leakage from the battery, please design a battery compartment structure and position which is completely independent from the rest of the instrument.

⑦ Please design the battery compartment to allow for the exhaust of gas and heat generated by the battery. When a completely airtight enclosure cannot be avoided, please attach functions such as safety valves for gas exhaust.

⑧ If the instrument generates heat, please position the battery compartment as far away from the heat source as possible.

⑨ The material used in the battery compartment should account for shock absorption and the environment. When vibration and impact are expected, the battery compartment structure should be designed to absorb such forces.

⑩ Please exercise caution regarding the contact material and shape of the battery terminals to ensure electrical contact even when a battery with the boundary tolerance dimensions defined in the product dimension diagram is used.
Please use nickel plated stainless or steel materials for the contact points. When reducing the contact resistance is particularly necessary, please use gold plating.

⑪ The contact force on the instrument battery terminals should be over 10N (1kgf) and less than 30N (3kgf).
This applies to M type batteries only.

⑫ The instrument's internal circuit should avoid electrical contact with the battery other than through the battery terminal contact points.

⑬ Please design the battery terminal contact structure such a way that reverse mounting is not possible, by utilizing the difference in shape between the battery's positive (+) electrode and its negative (-) electrode.

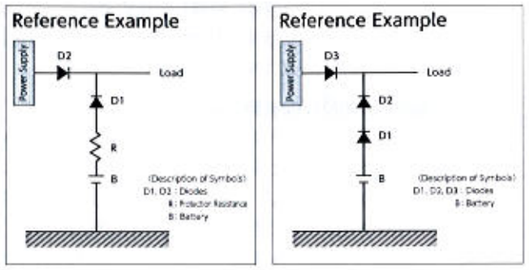
⑭ Please design the circuit such that forced discharge or charging of the battery does not occur when using an external, replacement power source.

⑮ Please install a protection circuit to ensure the prevention of battery charging.

⑯ Please design the battery position in the instrument such that the positive terminal is not faced downward.
When the battery is discharged with the positive electrode faced down, liquid thionyl chloride, the positive electrode substance, may become unevenly distributed and cause ununiform response. Especially when large current is used, the battery may not perform to the designed characteristics.

(2) Precautions for using as memory backup

① Please do not charge the battery because the battery is not chargeable.
When charged, electrolyte heating inside the battery may generate gas and increase internal pressure, resulting in fluid leakage, heating, explosion, and ignition.
When using as memory backup, please attach the reverse current (charging) prevention diode and protection resistance to avoid current flow from the main power source to the battery circuit.
UL1642 Lithium Batteries (U.S. safety standard) defines the installation of the above diode and the protection resistance in series when using lithium primary battery as a backup in instruments (Refer to the diagram below).
Use a diode with a leakage current below 0.5μA, and design the circuit to contain the reverse current charge amount for the entire use period to be below 3% of the nominal capacity.



② Please do not connect to the power source in series under the condition where the forward current in the battery increases.

③ Please do not directly solder or spot weld onto the battery when connecting lead wires; always connect to tab terminals. When soldering onto the tab terminal, use a soldering iron temperature below 370°C and solder for under 5 seconds.

④ When using the automatic soldering machine, immerse only the battery tab terminals into the bath, and exercise caution to not stop or drop the battery in the bath. Please position a barrier (such as the printed circuit board) between the battery and the soldering bath. Dropping the battery may cause explosion or ignition.

⑤ For instruments which generate heat, separate the battery from the heat source. When the heat source is close, attach a barrier between the heat source and the battery.

⑥ When designing the instrument, please consider the fact that in batteries stored for a length of time longer than 6 months following manufacture, in batteries used with large load current, and in batteries used for the first time in low discharge temperatures, a film of lithium chloride may form on the negative electrode lithium surface and cause a temporary drop in voltage. In such cases, discharging can prevent voltage drops. Please contact us regarding the conditions for discharging.

(3) Precautions in manufacturing the instrument

① Please do not apply ultrasonic vibrations to the battery. When ultrasonic vibration is applied to the battery, the contents may pulverize and cause internal shorts in the battery, resulting in fluid leakage, heating, and explosion.

② Battery may be disposed as general, non-combustible garbage. However, please dispose in accordance with local government regulations if applicable.
When storing or discarding batteries, please attach insulation to the terminals, such as tape.
When batteries are mixed together or mixed with other metals, they may become shorted, causing heating, explosion, and ignition which may result in injuries and fire. Do not dispose batteries into fires. Batteries thrown into fires may rapidly heat and cause explosions.

③ Prior to mounting batteries to instruments, please clean the instrument and the battery terminals. When the terminals are dirty, the instrument may not operate properly due to contact failure.

④ When measuring battery voltage, please use voltage meters with high internal resistance.
Please use voltage meters with a tolerance under 0.25% of nominal voltage, and a rated input impedance above 10MΩ.

(4) Precautions for battery replacement

This battery is certified by the UL standard. When registering this battery as a UL standard certified part in instruments certified by the UL standard or planned to be certified by the UL standard, the repair of the circuit related to the battery and replacement of the lithium battery basically must be performed by a skilled engineer, as a rule.
Please mention that the battery cannot be replaced in the instrument users manual for customers.

(5) Precautions for the transportation, display, and storage of the battery

① The storage location of the battery should not have a high temperature or high humidity. The location should have good air circulation, with dry air and moderate temperature in order to prevent dew condensation.
It is requested to store battery at 10～25℃ range, but not to exceed 30℃, and relative humidity under (55±20)%.
Storage at high temperatures and high humidity will degrade battery performance and accelerate fluid leakage.

② When storing or displaying in shops, please do not position in direct sunlight for extended periods of time or in the rain.
Exposure to high temperature increases performance degradation and makes fluid leakage more likely. Wetting the battery decreases insulation, making corrosion and fluid leakage more likely.

③ During transportation, please do not handle roughly.
Rough handling may cause dents and deformities which may cause performance degradation and fluid leakage. When the case that houses the batteries is damaged and several batteries are mixed together, the positive (+) terminals and the negative (-) terminals may short, causing heating, damage, fluid leakage, explosion, and ignition.

④ When stacking batteries in shipping boxes, please limit the number of stack levels to within the number specified on the shipping box. When the shipping boxes are stacked too high, the batteries at the bottom may become deformed or fluid leakage may be accelerated.

⑤ When transporting, displaying, and storing during distribution, first-in first-out is recommended in order to avoid extended storage in inventory.
Under normal temperature and humidity conditions (normal temperature 20℃±15℃, relative humidity under 70%), the battery has sufficient storage quality. However, extended periods of inventory may cause performance to degrade, observe strictly the appropriate volume of inventories and the first-in first-out.

2. Precautions for product use

Please mention the following cautionary note regarding battery handling in the instrument users manual, for the customers to use the product properly.

<Precautionary note on battery handling for placement in the instrument users manual>

The battery uses a sealed construction made of Glass Seal and Laser Welding Seal to contain lithium and thionyl chloride. Improper handling may cause fluid leakage, heating, explosion, and ignition, resulting in injuries and instrument failure, so please follow the precautions below

⚠Warning

① Do Not Charge

② Please store the battery in locations that small children cannot reach. If the battery is accidentally swallowed, please see a doctor immediately (to be displayed for small batteries only).

③ Please do not charge the battery, ever.
When charged, the electrolyte inside the battery is heated which may generate gas and increase internal pressure, resulting in fluid leakage, heating, explosion, and ignition.

④ Please do not use this battery for purposes other than the specified objective. Terminal construction may not match the instrument and may cause contact failure or be unsuitable for specification and performance. The battery may leak fluid, heat up, explode, or ignite.

⑤ Please do not throw the battery into fires, heat, disassemble, or modify. The Glass Seal or the Ventilation (Gas Exhaust Valve) may be damaged and may cause the battery to leak fluid, heat up, explode, or ignite.

⑥ Please do not use the battery with the positive (+) and negative (-) terminals reversed. Irregular reaction may be caused by charging and shorting, and may cause the battery to leak fluid, heat up, explode, or ignite.

⑦ If the battery fluid comes in contact with the eye, eye disorders may result. Do not rub the eyes, wash thoroughly with clean tap water, and see a doctor for medical treatment.

⑧ If battery fluid comes in contact with the tongue, immediately gargle and see a doctor at once.

⑨ Please do not connect the battery's positive (+) terminal with the negative (-) terminal using wires, or carry or store while wearing metallic necklaces and hair pins. Irregular reaction may be caused by charging and shorting, and may cause the battery to leak fluid, heat up, explode, or ignite.

⑩ When battery fluid leaks or a foul odor is emitted, immediately discard the battery as the electrolyte may cause metal corrosion.

⑪ Please do not mix new batteries with used batteries or batteries of a different brand or type. The battery may leak fluid, heat up, explode, or ignite due to differences in characteristics.

⑫ Please do not solder directly onto the battery.The heat may cause the Glass Seal or the Ventilation (Gas Exhaust Valve) to be damaged and may cause the battery to leak fluid, heat up, explode, or ignite.

⑬ Please do not remove or damage the battery's external label (Thermal Contraction Tube). The battery may short, leak fluid, heat up, explode, or ignite.

⑭ Please do not apply strong force to the battery by dropping or throwing it. The battery may leak fluid, heat up, explode, or ignite.

⑮ Please do not deform the battery.The Glass Seal or Ventilation (Gas Exhaust Valve) may be damaged and may cause the battery to leak fluid, heat up, explode, or ignite.

⑯ When storing or discarding batteries, please attach insulation to the terminals, such as tape. Mixing with other batteries and metal objects may cause the battery to short, causing heating, explosion, and ignition.

⚠Caution

① Please do use or leave batteries unattended in a high temperature environment such as inside vehicles or locations that are exposed to strong direct sunlight.The battery may leak fluid, heat up, or explode.

② Please do not wet the battery. The battery may heat up.

③ Batteries may not have suitable specification or performance depending on the method of use or the instrument. Please follow the instrument's user manual and cautionary notes, and use the battery correctly for its intended purpose.

④ Please store the battery in locations without direct sunlight, high temperature, and high humidity. The battery may leak fluid, heat up, or explode. Also, the performance and life cycle of the battery may degrade.

⑤ This battery may be disposed as general, non-combustible garbage. However, please dispose in accordance with local government regulations where applicable.

⑥ Please remember to turn the instrument's power off.

⑦ When storing batteries extracted from the package, please exercise caution to not short the batteries through contact with each other.

⑧ Thionyl Chloride Lithium Battery (3.6V) is not compatible in voltage or shape with the other primary batteries. Please use only with the specified, dedicated instrument.

⚠ 安全上のご注意　ご使用の際は、取扱説明書をよくお読みの上、正しくお使いください。

電池は、通常の使用条件下では安心してご使用頂けますが、万一誤った取扱いをしますと発熱、液漏れ、破裂、発火したり、けがや機器故障の原因となるおそれがありますので、次の点に注意してご使用ください。
充電式電池につきましては、電池本体及び包装台紙の安全上の注意、使用上のお願いを必ずお守りください。

1 安全上、次のことに注意してください。

(1)電解液の対応処置　**電池内部からの電解液には、直接触れないように注意してください。**
電池の電解液が付着すると衣服の損傷や皮膚のただれを起こすばかりではなく、目に入った場合は、失明する場合があります。特にアルカリ性溶液が目に入った場合は、直ぐに水で洗い流し医師の治療を受けてください。甚だしい場合はすぐにうがいをして医師に相談し、また皮膚や衣服に付着した場合はまず洗い流してください。

(2)充電　**電池を充電しないでください。(充電式電池は除く)**
一次電池は、充電用として作られていないので、充電しないでください。充電すると、電池内部にガスが発生し、発熱、破裂または発火するおそれがあります。

(3)ショート　**電池の⊕、⊖をショートさせないでください。**
電池の⊕、⊖端子を針金などで接続したり、また金属製のネックレスやヘアピン、コイン等などと一緒に持ち運んだり、保管しないでください。電池がショート状態となり、過大な電流が流れ、発熱のため電池構造が破損し、発熱、漏液、破裂または発火するおそれがあります。

(4)分解　**電池を分解しないでください。**
電池の外装チューブやラベルを剥がしたり、キズつけないでください。無理に電池を分解しようとすると、手指を傷つけたり、電池内部の電解液等が飛び散って目を傷めたり、皮膚を荒らしたりするおそれがあります。漏液した電解液も同じく、直接人体に触れないでください。もし触れた場合は直ぐに水で洗い流してください。アルカリ一次電池には、強アルカリ液が使用されているので、皮膚をただれさせたり、目に入った場合には失明のおそれがあります。二酸化マンガンリチウム一次電池の場合、分解すると内部の金属リチウムが露出し、水分と接すると激しく反応して、発火につながるおそれがあります。

(5)加圧変形　**電池を加圧変形しないでください。**
電池を加圧変形させると、電池封口部のゆがみによって漏液、内部ショートなどの異常を生じることがあります。また内部ショートによって発熱、漏液、破裂または発火するおそれがあります。

(6)加熱　**電池を加熱しないでください。**
電池を加熱すると、絶縁物やガス排出弁などを損傷させたりして、電池を漏液、発熱、破裂させるおそれがあります。

(7)火中投下　**火の中へは電池を入れないでください。**
電池を火の中に投棄すると破裂したり、激しく燃えることがあり、(6)の加熱で述べた以上に危険です。

(8)はんだ付け　**電池端子に直接はんだ付けしないでください。**
電池に直接はんだ付けすると、電池が加熱され、(6)の加熱で述べたことと同じ理由で同現象が起るおそれがあります。

(9)衝撃　**電池に強い衝撃を与えないでください。**
電池を落下させたり、投げつけたりして、強い衝撃を与えると、電池内部の絶縁物や構造などを損傷し、漏液、内部ショートなどの異常を生じることがあります。また内部ショートによって、発熱、漏液、破裂または発火するおそれがあります。

(10)逆装填　**電池の⊕、⊖を正しく装填してください。**
電池の⊕⊖を逆装填すると、機器によっては電池が充電やショートなどで異常反応を起こし、発熱、漏液、破裂または発火するおそれがあります。

(11)過放電　**電池を過放電(過度の使用状態)しないでください。**
電池は、機器が正常に作動しない状態になってからも、電気回路がつながったままで(スイッチの切り忘れなどによって)放置されると、電池内部の消耗が継続され過度の放電状態となり、内部でガスが発生し、漏液や破裂の原因となったり、機器を破損させるおそれがあります。2個以上の電池を接続使用し過放電すると電池電圧が0V以下(転極)することがあり、更に漏液や破裂が起こりやすくなります。

(12)混用　**「銘柄や種類の異なる電池」や「新しい電池と使用した電池や古い電池」を混ぜて使わないでください。**
銘柄や種類の異なる電池を混ぜて使うと、機器が正常に作動しないばかりではなく、それぞれの放電性能が異なるので、早く消耗した電池が過度の使用状態(過放電)となり漏液や破裂の原因となります。また、新しい電池と使用した電池や古い電池を混ぜて使うと、使用した電池や古い電池が過度の使用状態(過放電)となり、不経済なばかりではなく、漏液や破裂の原因となりますので、電池を交換するときは全数を一度に行ってください。

2 飲み込み事故防止のため、次のことに注意してください。

小型電池(単4形、単5形、ボタン形、コイン形電池など)は、幼児が口に入れやすく、ときには飲み込んでしまう恐れがありますので、電池は幼児の手の届かない所においてください。
万一飲み込んだ場合には、直ぐに医師に相談してください。

⚠ Safety Precautions

Although batteries are safe to use under normal conditions, improper handling may result in a personal injury or equipment failure from heating, electrolyte leakage, rupturing or fire. For safe to use of batteries, be sure to follow the instructions below. With regard to rechargeable batteries, follow the instructions printed on battery casing and packaging paper card.

1 Observe the following precautions to ensure safety.

(1) Electrolyte First-Aid　**Be careful not to directly touch any electrolyte leakage from a battery.**
Be careful not to directly touch any electrolyte leakage from a battery.
If the battery electrolyte leakage contacts your clothing or skin, it may damage the clothing or corrode your skin. Should it get into your eyes, it could cause loss of eyesight. If alkaline electrolyte in particular gets into your eyes, immediately rinse them with plenty of water and seek medical advice. If licked, immediately rinse your mouth with plenty of water and seek medical advice. If the electrolyte leakage contacts your clothing or skin, flush the affected area repeatedly with water.

(2) Charging　**Do not charge batteries (except rechargeable batteries).**
Do not attempt to charge primary batteries, because they are not designed for charging. If an attempt is made to charge them, gases generated within the battery can cause overheating, rupturing or fire.

(3) Shorting　**Do not short-circuit the positive (+) and negative (-) terminals.**
Do not connect the positive (+) and negative (-) terminals of a battery with a wire, or carry or store batteries together with metal necklaces, hairpins, coins or other metallic objects in order to avoid a short-circuit. If short-circuited, excessive current will flow, possibly damaging the battery structure due to the generated heat, with the possible result of overheating, leaking, rupturing or fire.

(4) Disassembling　**Do not attempt to disassemble a battery.**
Do not attempt to peel off or impair the battery outer tube or the label. If you attempt to disassemble a battery forcedly, you can get your hands or fingers injured. If the electrolyte inside the battery gets into your eyes or adhere to your skin, you can get your eyes or skin injured. Do not allow leaked electrolyte to come into contact with the human body. If this happens, rinse with a large quantity of water immediately. Alkaline primary batteries contain a strong alkaline acid, which can corrode your skin or cause loss of eyesight. If a manganese dioxide lithium primary battery is disassembled, the internal metallic lithium is exposed, which reacts violently on contact with water, causing fire hazard.

(5) Deforming　**Do not deform a battery.**
If you deform a battery by excessive pressure, the seals may become warped and cause leaking, an internal short-circuit or other abnormalities.
An internal short-circuit or other abnormalities can cause overheating, leaking, ructure or fire.

(6) Heating　**Do not cause the battery to become heated.**
If the battery is heated, the insulator, the gas exhaust valve or other parts may be damaged, possibly causing leaking, overheating and rupturing.

(7) Disposing of in Fire　**Do not throw a battery into a fire.**
A battery may rupture or burn violently when thrown into a fire. This can be more dangerous than the events described in paragraph 6.

(8) Soldering　**Do not directly solder anything onto the battery terminals.**
Direct soldering onto the battery terminals causes the battery to be heated, and the events described in paragraph 6 can occur as a result.

(9) Impact　**Do not give a strong impact to a battery.**
If a battery is fallen, thrown or otherwise given a strong impact, the insulator in the battery or its structure may be damaged, possibly causing leaking, an internal short-circuit or other abnormalities. An internal short-circuit can cause overheating, leaking, rupturing or fire.

(10) Reverse Battery　**Insert a battery with the positive (+) and negative (-) terminals oriented correctly.**
If a battery is inserted with reversed terminals, abnormalities can occur due to charging, a short-circuit, etc., with the possible result of heat generation, leaking, rupturing or fire.

(11) Overdischarge
If an electric circuit is left connected (e.g., you forget to turn off the power switch) after equipment has entered an unoperational state, a battery continues to be drained, leading to an overdischarge situation. Consequently, gases generated within the battery can cause leaking or rupturing, or damage the equipment. If two or more batteries that are connected together are overdischarged, the battery voltage can drop below 0 V (as a result of polarity inversion), further increasing the possibility of leaking or rupturing.

(12) Mixed Use　**Do not mix different types of batteries together, and do not mix used and new batteries.**
Your equipment may not operate properly if batteries of different voltages and types are used together. In addition, the battery exhausted first may be excessively drained (overdischarged) due to different discharge characteristics, which may eventually result in leaking or rupturing of the battery. When used, new and/or partially used batteries are used together, used and partially used batteries will be excessively discharged. This is not only uneconomic but also may cause the battery to leak or rupture. Replace all batteries with new batteries at the same time.

2 Observe the following safety precautions to prevent batteries from being swallowed.

Small-size batteries (e.g., AAA size, N size, button cells, coin cells) can easily be picked up by little children and swallowed.
Keep all batteries out of reach of little children. Consult a doctor immediately if a battery is swallowed.

TOSHIBA

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●商品のデザイン・仕様などは改善のため予告なく変更することがあります。

●Picture shown may vary from actual product.
●Product specification subject to change without notice.

このカタログ内容は平成28年5月現在のものです。

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