Safety Precautions when using Alkaline Button Batteries in Series

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Primary Battery Division
Product Liability Committee
Battery Association of Japan

Recently, there have been accidents caused by battery rupture in application such as LED lights that use three or more alkaline button batteries (e.g. LR44) connected in series.
Alkaline button batteries may internally generate gases due to over-discharge* or improper use. In particular, when three or more batteries are connected in series, the battery that expires first due to slight variations in performance is forcibly discharged by the other batteries, reaching an over-discharged state. As a result, the pressure inside the battery tends to increase as gases are generated. Since alkaline button batteries do not have a mechanism to vent gases and release internal pressure, the increased internal pressure may break the seal, rupturing the battery.
Please observe the following precautions to prevent accidents.

◇Precautions for users

- Do not leave the batteries in application after they have expired.
    - Remove the batteries and replace all of them with new ones when:
      in the case of lights and similar devices, the light first begins to dim,
      for other types of devices, movement or reaction begins to slow down or volume becomes quieter.
- Do not short-circuit batteries.
- Do not use new and old batteries together.
- Do not use batteries of different types/manufacturers together.
- Do not use batteries in reverse polarity.

◇Precautions for application manufacturers

- Conduct a safety assessment at the design stage that includes batteries.
- Include highly reliable batteries in packaging.
- Install an over-discharge prevention mechanism.
- Avoid connecting three or more button batteries in series.
    - *For more information, contact the battery manufacturer.

*What is “over-discharge”?:

- A battery is over-discharged when it falls below the allowable voltage. Batteries may
  have over-discharged when a light dims, movement or reaction time slows, or volume
  becomes quieter, depending on the type of equipment.