BATTERY RELATION BETWEEN CONSTRUCTION AND RISKS

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GRINNER x BATTERIES ROUNDTABLE

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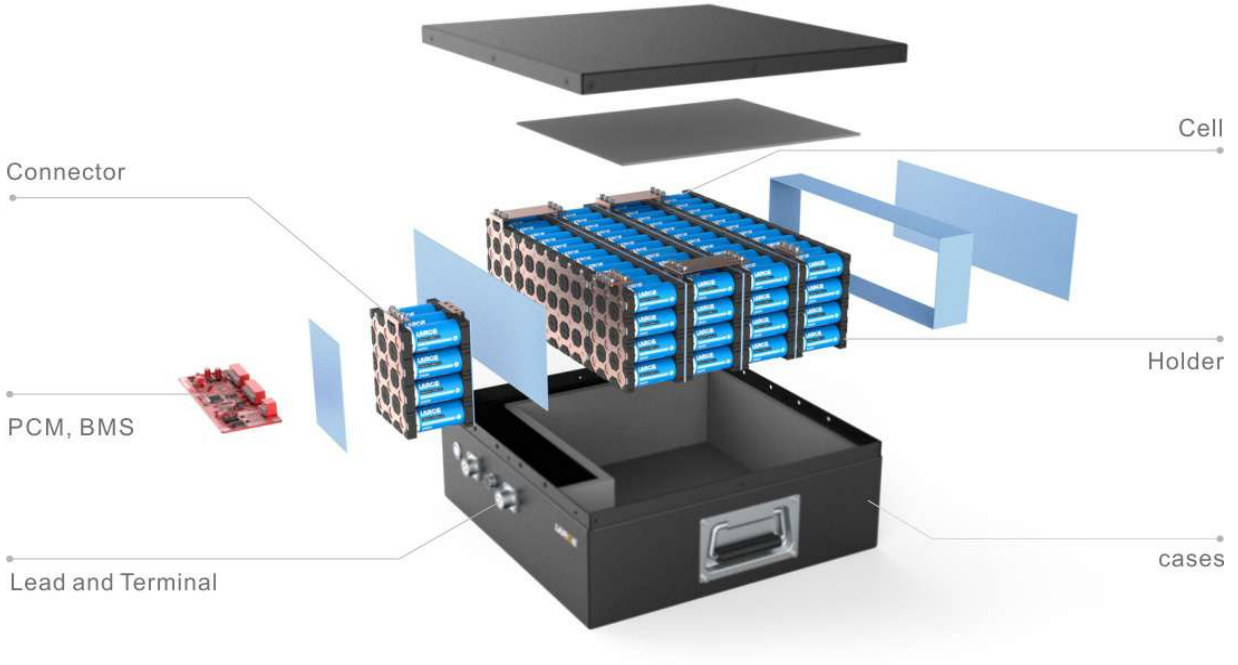
DEFINITION

- '**Battery**' means **any device delivering electrical energy generated by direct conversion of chemical energy**, having internal or external storage, and consisting of one or more non-rechargeable or rechargeable battery cells, modules or of packs of them, and includes a battery that has been subject to preparation for re-use, preparation for repurposing, repurposing or remanufacturing.

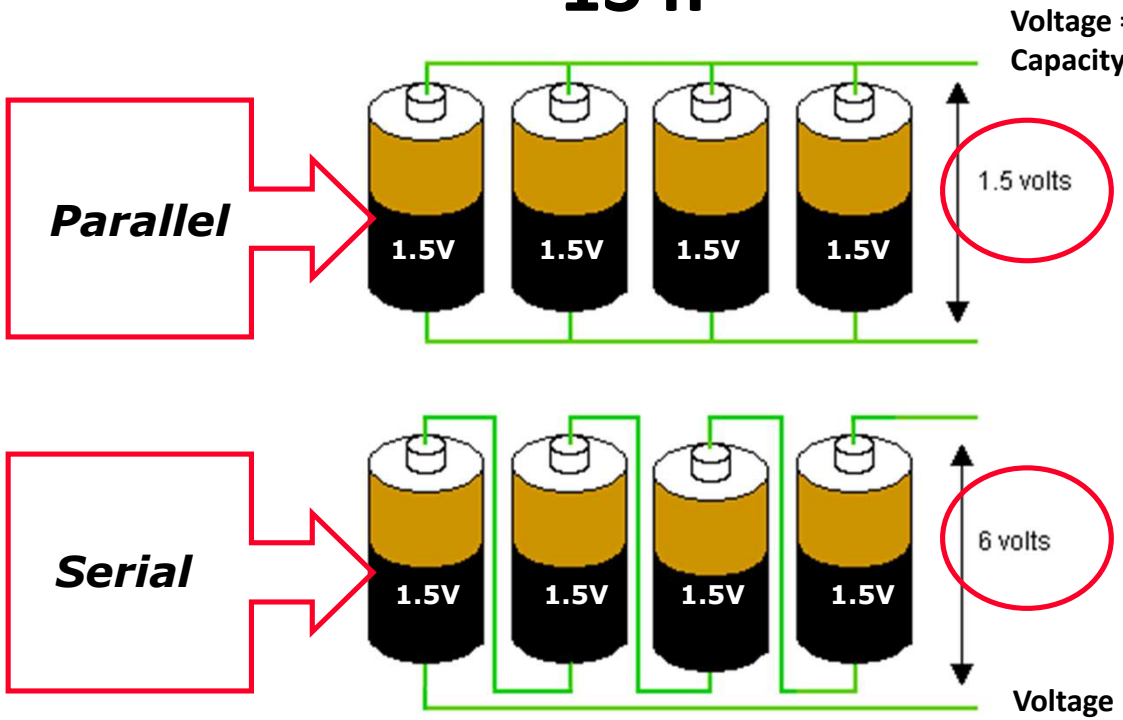
LARGE LITHIUM ION BATTERIES DO NOT EXIST !



CELL ***MODULE*** ***PACK***

SERIAL AND PARALLEL CONNECTIONS

1S4P



Voltage = 1 battery
Capacity x 4 batteries

Ex. 9V

Voltage = 4 battery
Capacity x 1 batteries

4S1P

RISKS

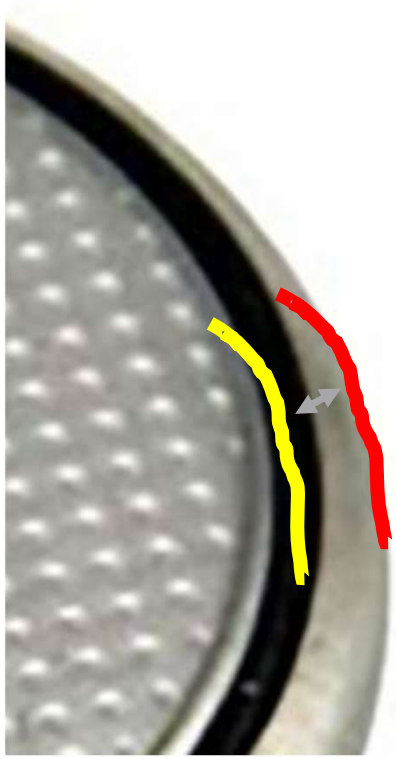
SHORT CIRCUIT

RISKS – SHORT CIRCUIT

➢After a battery-operated appliance has stopped working, the batteries usually still have between **60 – 90%** of the nominal voltage (voltage on the label). This means that the majority of used batteries can be dangerous for short circuit.

Nominal voltage = 36V

DEFINITION OF SHORT CIRCUIT = CONTACT BETWEEN THE + AND – POLE OF THE SAME PACK/BATTERY/CELL



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\+

RISK = very small + / - = ± 6 cm
label/ not conductive

\+
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RISK = bigger + / - = ± 8 mm
label/ not conductive

\+


RISK = big + / - = ± 0.2 mm
all sides are conductive

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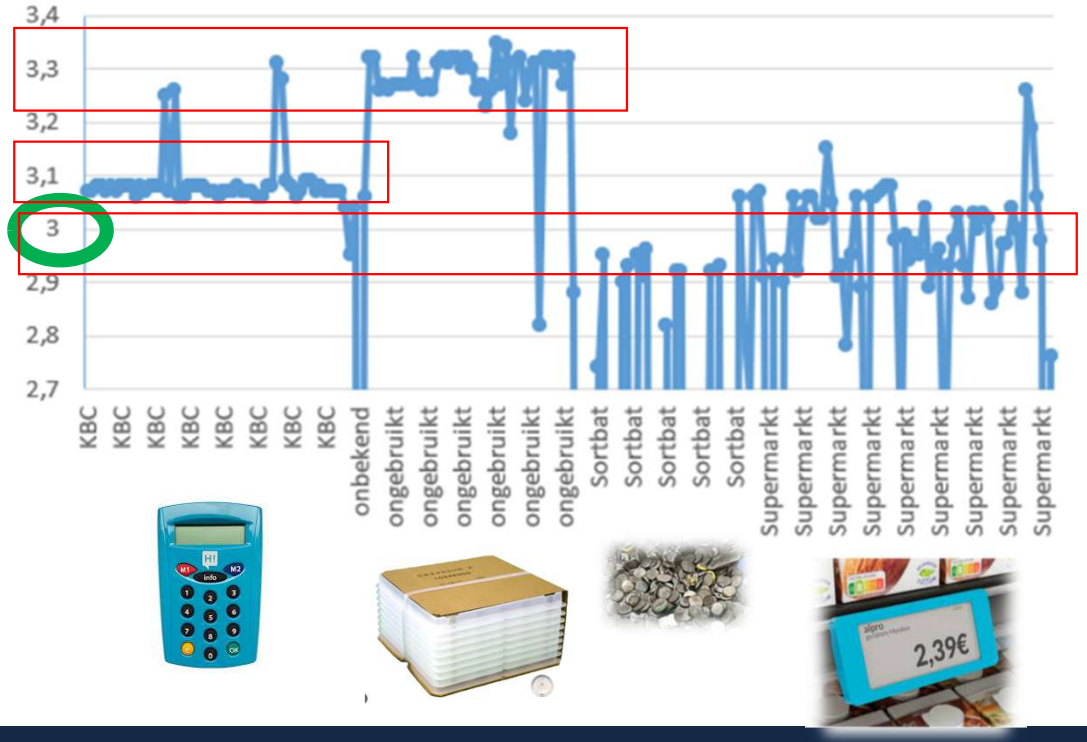
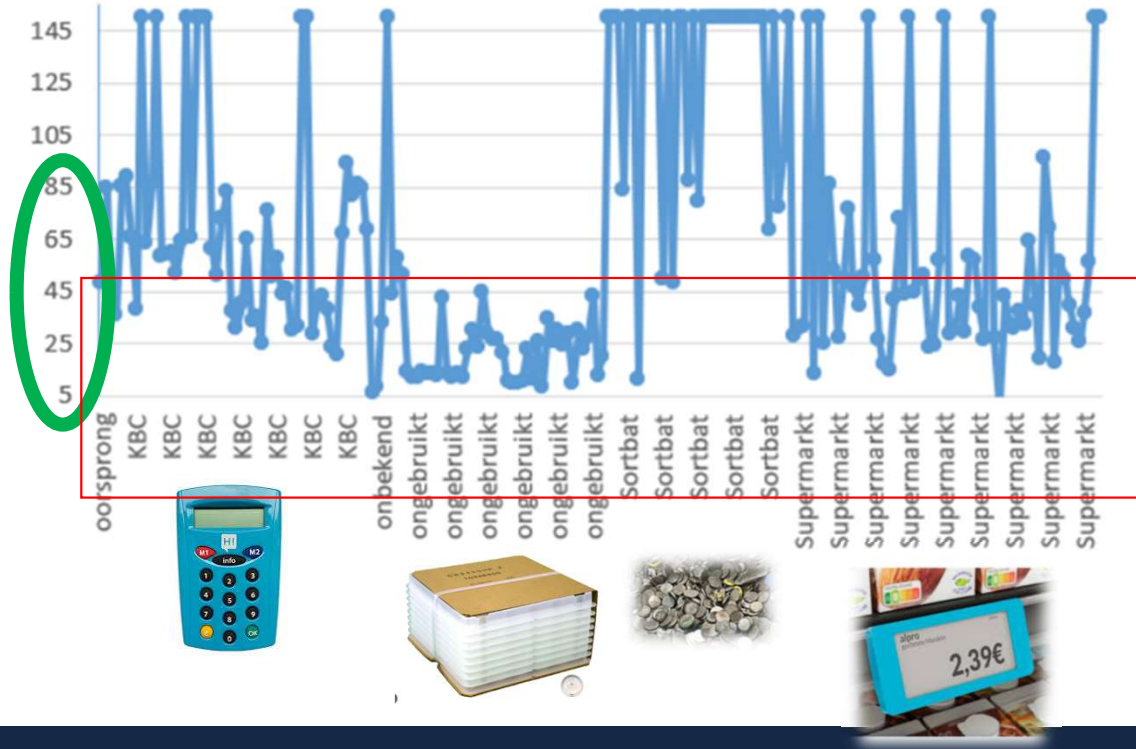
RISK - SHORT CIRCUIT - LITHIUM COIN CELLS

- Test on 200 coin lithium cells
  (ongebruikt – unused)
  (KBC – from used bank card reader)
  (Supermarket – Digital price tags)
  Sortbat – from sorting line (these have the lowest voltage and highest IR values – are safest from short circuit point of view)

Danger zone : still high V and low Ω





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LITHIUM BUTTON/COIN CELLS + 9V

unused 9V in short circuit

Up to 120°C

DISMANTLING OF LARGER VOLUMES

Dangerous - to just throw them together!!!

>1 per household ?

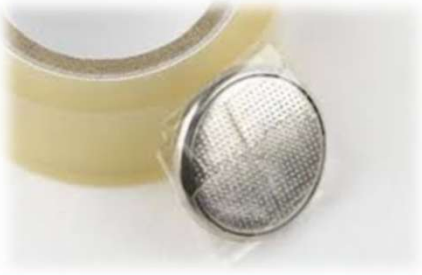
>17.000 per supermarket

>10 per household ?

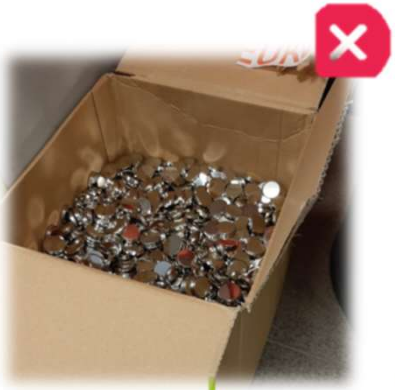
Some battery/WEEE handling facilities sometimes get very high volumes of small WEEE to dismantle the lithium button cells - **extreme care is necessary**!

AT HOME/AT WORK

Best protection of individual



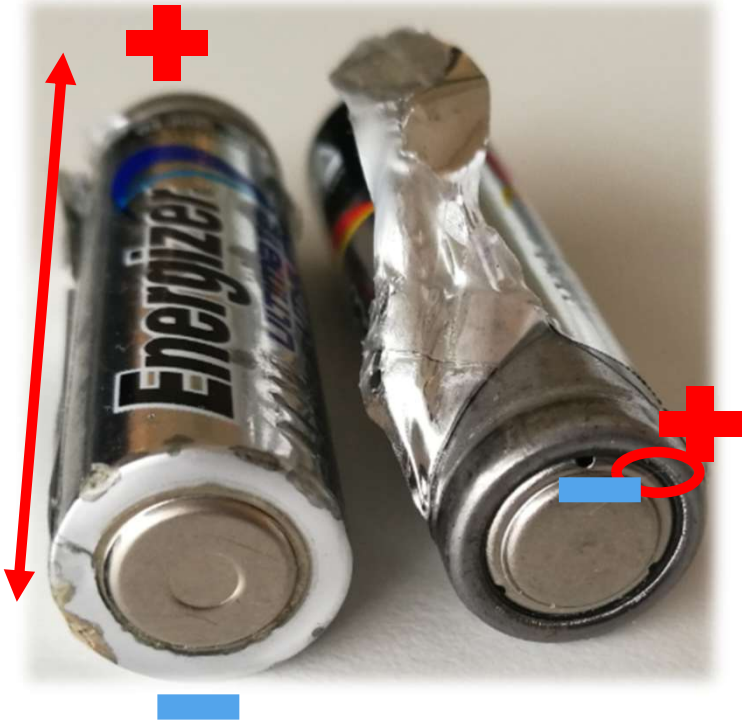
Avoid concentrations

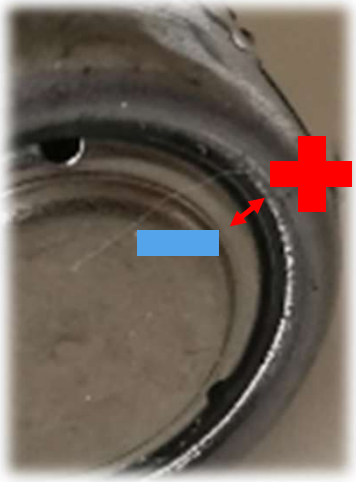


THE LABEL OF A CYLINDRICAL CELL IS ALSO A KIND OF PROTECTION AGAINST SHORT CIRCUIT

With a damaged or missing label, a cylindrical cell will be as vulnerable for short circuit as a button cell

+ / - = 6,5 cm

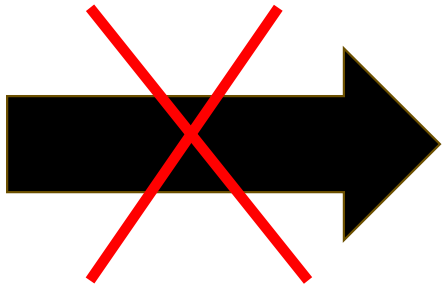




+ / - = 0,2 mm

SHORT CIRCUIT FROM NON-PROTECTED CONTACTS AND WIRES

- In view of remaining power in most batteries, packs and cells coming out of repairs and/or dismantling should be protected from short circuit by covering/isolating naked contacts and wires. By doing this one is not only protecting his own company from incidents, but also the transport company which will bring them to the next stakeholder in line and of course also this stakeholder. Because it is only waste, people seem to forget (or don't know) that it can be dangerous to just throw them together.

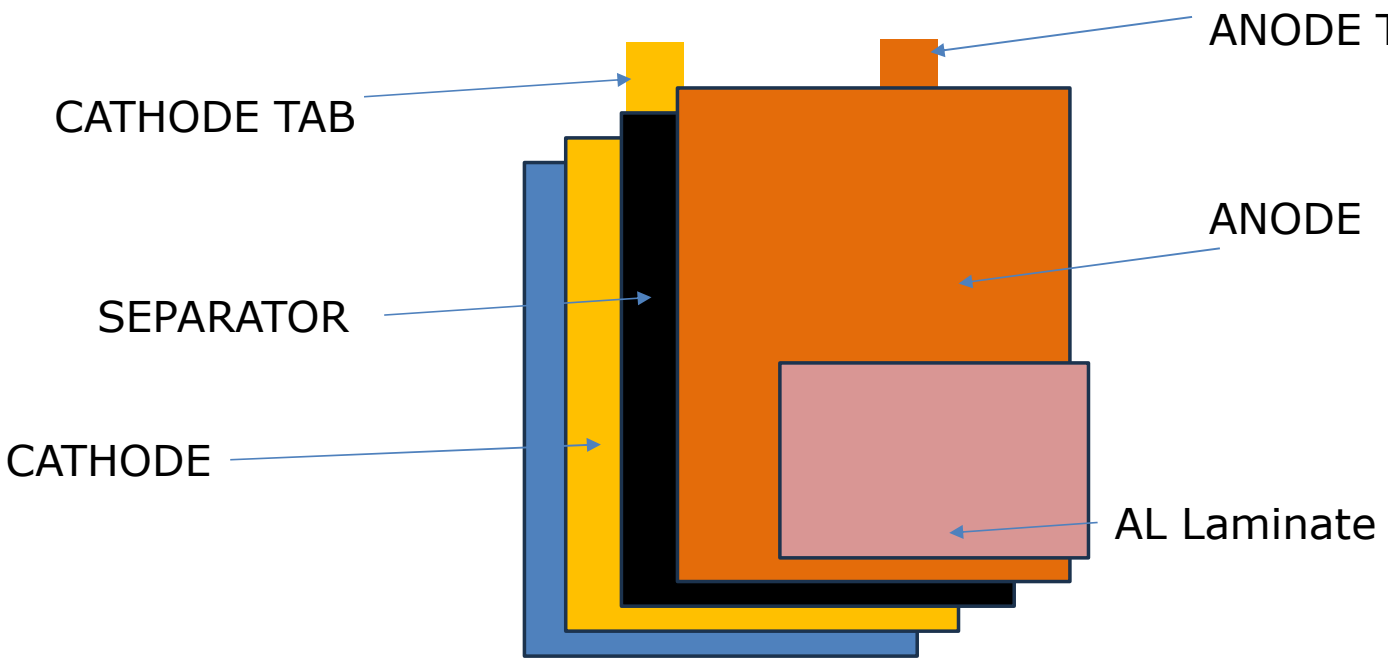


NON-PROTECTED PACKS FROM REPAIR OR DISMANTLING – BROUGTH TO RECYCLING PARKS

- Even in municipal recycling parks we give training to the staff in order to intercept larger battery packs with risks for short circuit where the person bringing them back did not think of securing them.

Roll 6-7 times in foil to protect contacts

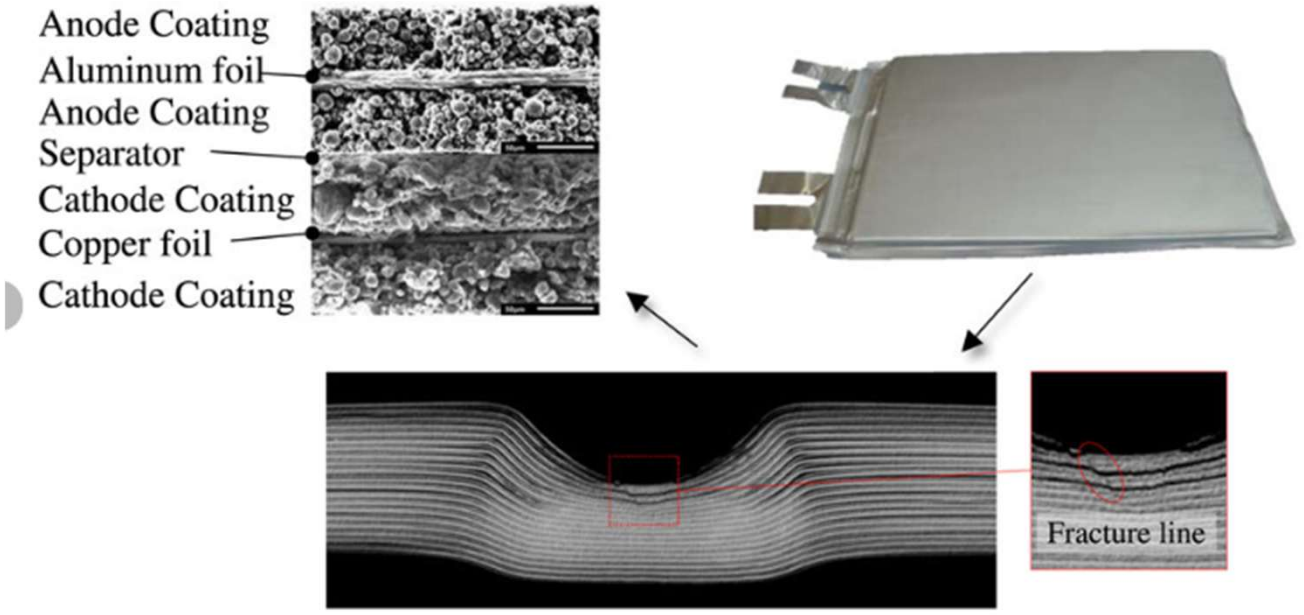
LITHIUM ION CELL CONSTRUCTION AND RISKS



- The separator is a very important part of the battery since it prevents internal short circuit. The separator is usually :
  - **made of PP or PE** and
  - **only a few micrometer thick** (µm) : 1/1000 mm
- These 2 specifications make the separator vulnerable for damage caused by external influence.

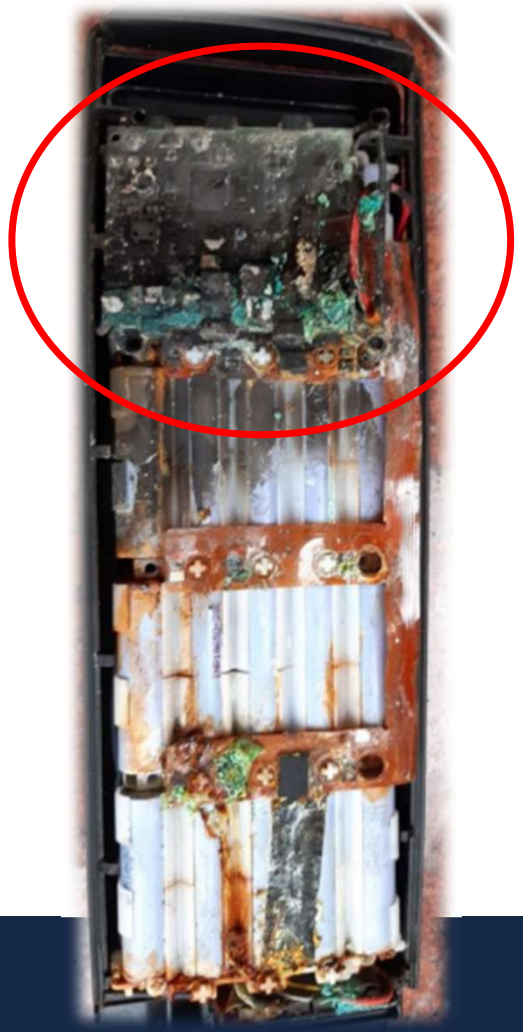
EMBEDDED BATTERIES IN WEEE

- Embedded batteries in WEEE are usually pouch cells/polymer batteries which are quite thin and easily damaged if through external pressure or damage they get crushed or punctured. The total thickness of many pouch cells is between 1 and 10 mm! This makes them quite vulnerable for internal damage due to pressure.



Internal multi-layer structure of a pouch cell and the cross-sectional view of its deformed configuration under mechanical indentation.

1. HEAT



Only upper module completely burned, maybe lower cells have heat-damaged separator

Heating the battery in order for the glue to loosen and get the battery easier out of a WEEE appliance

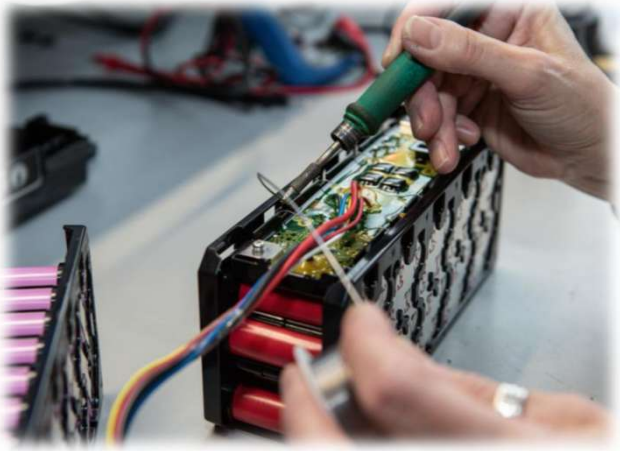
2. MECHANICAL DAMAGE

- Charging and discharging E-waste with mechanical tools or with manual high impact drops can damage the WEEE and the embedded batteries. Since it is possible that a reaction only comes hours or days later, an incident might occur “spontaneously”. A battery in good condition will normally not start burning “spontaneously”, and most fire incidents are most probably due to a former impact and/or damage caused by a manipulation or heave machinery impact.

- ❑ Incoming goods control
- ❑ Manual handling
- ❑ Compartmentation
- ❑ Camera security

SPONTANEOUS IGNITION?

- We can state that there is basically no spontaneous ignition of a battery. There is always some internal or external reason why batteries catch fire. Depending on the reason there can be a relatively long period between the real reason and the actual ignition, making it seem “spontaneous”. Based on knowledge, experience and logical deduction we can and we should act in a responsible way to avoid any potential risk with batteries and battery packs.
- A fall or impact could cause internal wiring to loosen and by getting in contact with other parts of the electronics create a short circuit. Since it is never totally clear if a battery still is in good enough condition to react wrongly, it is recommended not to throw used batteries or make them suffer hard blows.



INTERNAL SHORT CIRCUIT

- Example on a household appliance
  - Versuni is voluntarily recalling the battery packs of the Philips 2000 and Philips 3000 series cordless stick vacuum cleaners only.
    - ✓ This decision is in line with our unwavering commitment to ensuring the highest standards of quality, reliability and safety of our products.
    - ✓ If you have purchased the Philips 2000 or Philips 3000 series cordless stick vacuum cleaner, to receive instructions on how to replace the battery pack free of charge:

- While the risk to consumer safety is low, we ask that you:
  - immediately stop using the vacuum cleaner and unplug from charging
  - put the product on the ground
  - deplete the battery pack by switching on the product and let it run continuously until it stops operating
  - detach the battery pack and put it in a plastic bag
  - store it in a dry place
  - please follow guidance from your local and/or national electronic waste disposal service on how to dispose of the battery pack

Such products might end up in large volumes at WEEE recyclers or dismantlers and they should be aware to ask more information on the reason why so many of the same products are "offered" to them and in case the reason is the battery, be extra careful with handling and packaging!

SUMMARY

- Regardless of your interaction with used batteries :

  Be aware that used batteries usually still (partially) contain an electrical charge and that care and attention are necessary to keep things safe !

- ❑ Train people to recognize potentially dangerous batteries and battery situations
- ❑ Train people how to handle responsibly to avoid incidents at their place but also further up the chain
- ❑ Check regularly if all agreed actions are followed

Useful tips and tricks for such training can be found in the guidance document for waste lithium batteries!

THANK YOU

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