

Establishing harmonised methods to determine the capacity of all portable and automotive batteries and rules for the use of a label indicating the capacity of these batteries

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TAC Meeting

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Pioneer in the quantification tools and support for decision

- Specialists in the measurement environmental and health quality of products and services in France and Europe
- At the interface of the environment and products, a large range of services for public and private decisions makers

2 families of services:



Industrial ecology



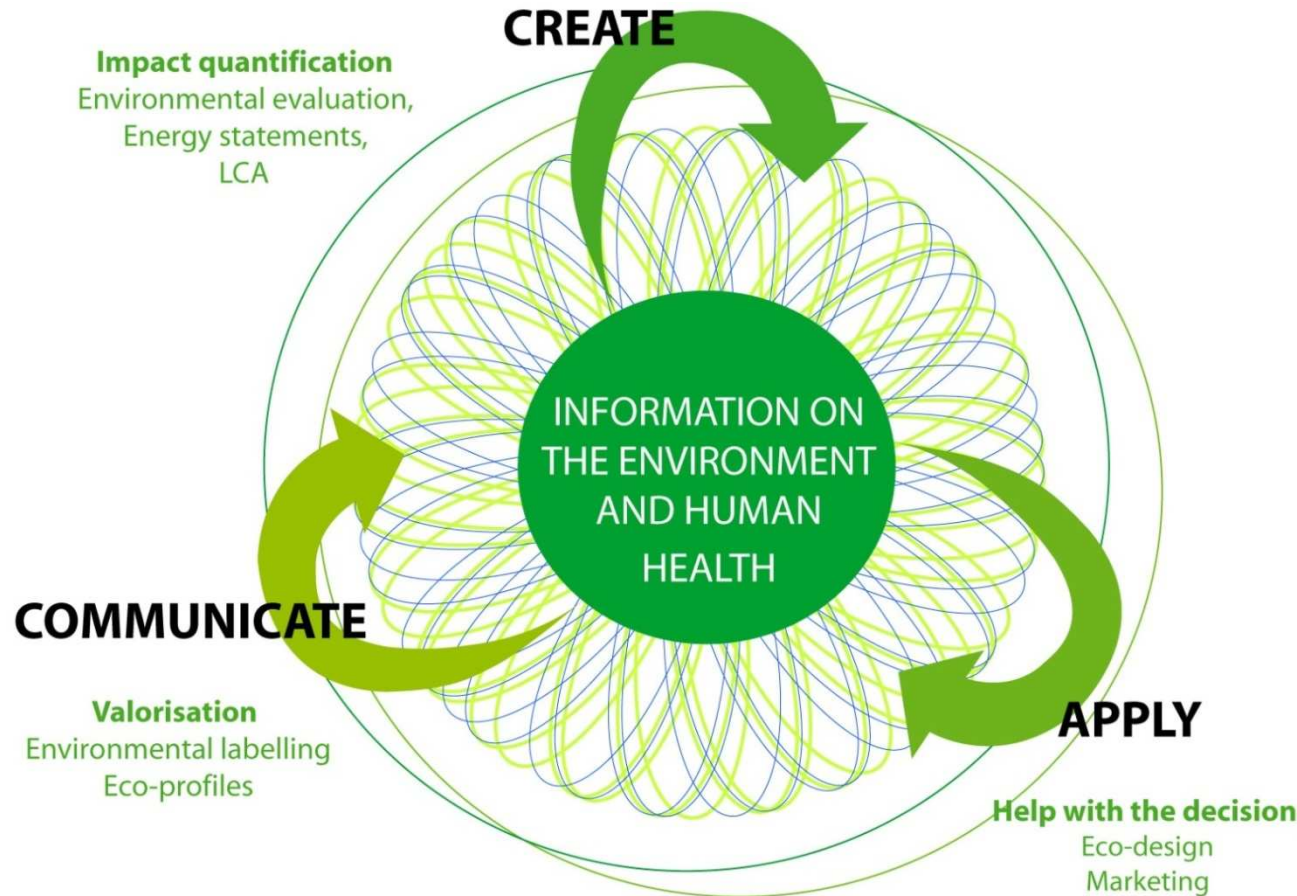
Nutritional health



A wide variety of sectors:

- Agro-alimentary
- Construction
- Distribution
- Energy
- Industry
- Transport
- Waste
- Services

BIO's activities



Since 1989, our references include:



Background

- **Annual EU market for batteries**
 - 190,000 tonnes of industrial batteries
 - 160,000 – 2000,000 tonnes of consumer batteries
 - 800,000 tonnes of automotive batteries
- **The Battery Directive (2006/66/EC)**
 - Entered into force on 26 September 2006
 - Article 21 .2: "Member States shall ensure that the **capacity of all portable and automotive batteries and accumulators is indicated on them** in a visible, legible and indelible form by 26 September 2009."
- **Objectives of the study:** determine harmonised methods to evaluate battery capacity and develop labelling options

- **Task 1 – Definition of harmonised methods**

- Task 1.1 – Background literature survey
- Task 1.2 – Capacity determination methods
- **Task 1.3 – Harmonisation of methods**
- Task 1.4 – Stakeholder Consultation (*25/03/2008 Brussels*)

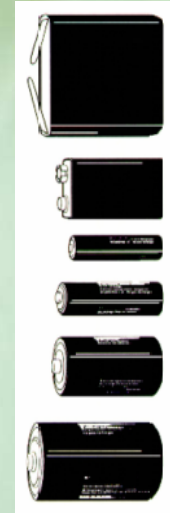
- **Task 2 – Capacity label design and application**

- **Task 2.1 – Capacity units**
- **Task 2.2 – Label design and layout**
- **Task 2.3 – Analysis of options**

Categories of products

● Primary batteries

- Functioning base on a irreversible chemical reaction (Alkaline, Zinc Carbon, Lithium, Zinc Air, Silver oxide, ...)
- Wide variety or shapes and sizes
- Can be used in a wide range of applications
- Commonly (and according to international IEC/EN standards) 3 categories of primary batteries: General purpose primary batteries, Watch batteries, and specialty batteries which are designed for specific applications (e.g. hearing aids, smoke detectors)



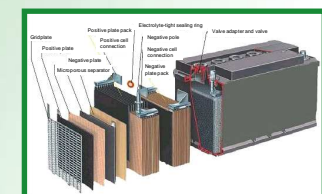
● Secondary batteries

- Functioning base on a reversible chemical reaction (Nickel Cadmium, Nickel-Metal Hydride, Lithium Ion, Lithium Polymer, Lead-acid)
- Portable secondary batteries with a standardised geometry and custom made battery packs



● Automotive batteries

- They are commonly called “Starter batteries”, and are used in vehicles as a power source and to start the engine (e.g. in a car, motorcycles)
- They are secondary batteries i.e. they can be recharged
- Two main functions: starting the engine and being a power supply for onboard electrical devices



International and European Standards for batteries (methods measuring battery capacity/ performance)

- **IEC and EN standards**

- **The study focuses on IEC standards:**

- Widely accepted in Europe and adopted as European norms (EN)
- Widely recognised by battery manufacturers, testing laboratories and certification bodies
- Cover all the products under the scope of the study (portable primary, portable secondary and automotive batteries)



International and European Standards for batteries

Scope		International standards (also European)
Portable Primary batteries	General purpose and specialty primary batteries	IEC/EN 60086:2 Primary batteries Physical and electrical specifications
	Watch batteries	IEC/EN 60086 :3 Primary batteries Watch Batteries
Portable Secondary batteries	Secondary cells and batteries containing alkaline or other non acid electrolytes	<p>IEC/EN 60622 Secondary cells and batteries containing alkaline or other non-acid electrolytes – sealed nickel-cadmium prismatic rechargeable single cells</p> <p>IEC/EN 61951-1 Secondary cells and batteries containing alkaline or other non acid electrolytes– portable sealed rechargeable single cells – Nickel Cadmium</p> <p>IEC 61951-2 Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Nickel-metal hydride</p>
	Sealed Ni-Cd and Ni-MH rechargeable single cells	
	Secondary lithium cells and batteries for portable applications	IEC/EN 61960 Secondary cells and batteries containing alkaline or other non-acid electrolytes – secondary lithium cells and batteries for portable applications
	General purpose lead-acid batteries	IEC/EN 61056:1 General purpose lead-acid batteries (valve-regulated types)
Automotive batteries	Lead-acid starter batteries	IEC/EN 60095:1 Lead-acid starter batteries General requirements and methods of test

Other standards (EN50342, ANSI, JIS, DIN...) also investigated

Definition of Capacity

- **Two definition exist**

- Technical definition: measure of the energy contained within a battery under set conditions (expressed in ampere hours Ah).
- Practical definition: provided in terms of “performance” instead of “capacity”.

- **Portable primary batteries**

- Performance: service hours within a specified application
- Performance: pulses (e.g. photo flash)
- Capacity: rated capacity in mAh

- **Portable secondary batteries**

- Capacity in mAh

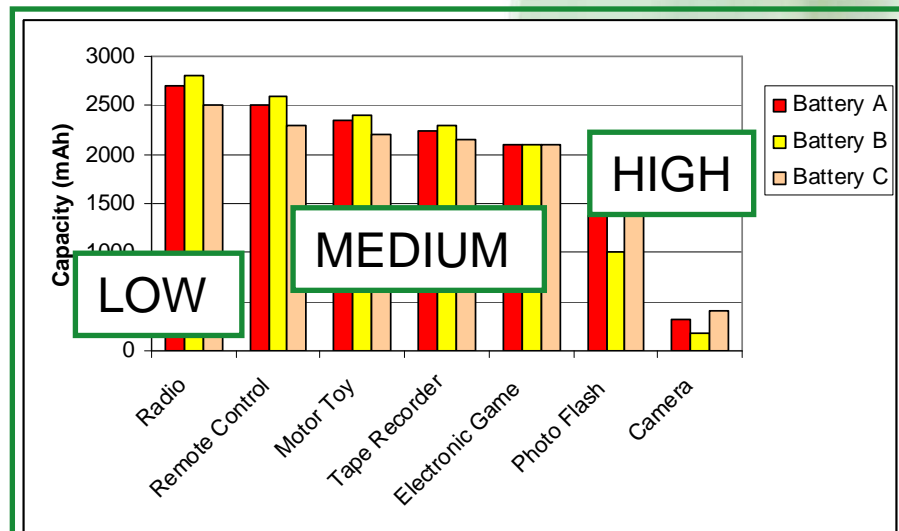
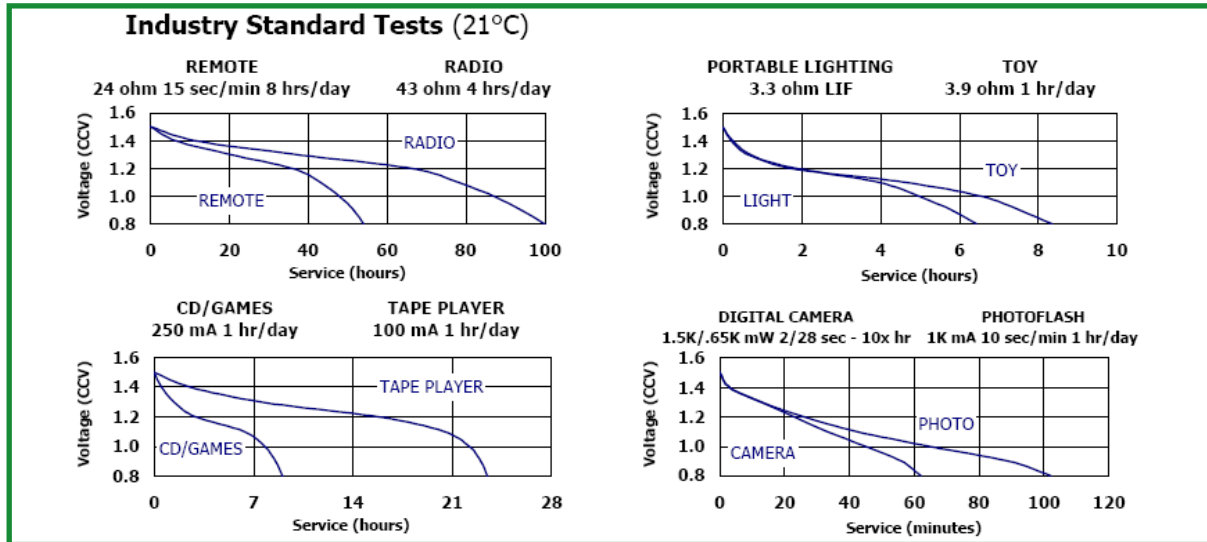
- **Automotive batteries**

- Capacity in Ah provides indication on the ability of the battery to store energy
- The ability to start an engine is further provided by an indication of the capability of the battery to start an engine which refers to the measurement of the “Cold Cranking Amperes” CCA

Parameters influencing the capacity/performance:

- Electrochemical composition
- Battery size
- Battery's internal resistance
- Temperature and relative humidity
- Frequency of use, usage pattern and ageing
- Battery discharge type (constant current/resistance/power)
- **End-use application**
 - In the case of secondary batteries, their technology allows having low internal resistance, leading to lower variation of the capacity depending on the end-use application: **a single rated capacity can be determined**
 - For general purpose primary batteries, the comparison of the performances of two distinct batteries can therefore only be established regarding a specific end-use application that will impose the discharging rate through its resistance


Parameters influencing the capacity/performance:



Task 1.2 Capacity determination methods

Primary Batteries:

- **IEC 60086 standard:** About 90 different types of application tests or service output tests and between 1 and up to 7 tests for each model of battery
 - **General purpose primary batteries:** a **single value of the rated capacity cannot be defined for a general purpose primary battery.** The IEC 60086-2 defines several application tests per type of battery (up to 7 tests for the LR6 battery) to measure the service output of the battery in different applications.

Type	V _n (V)	Resistance (Ω)	Daily period	End-point voltage	Min. Average Duration	Application
 LR6	1,5		Please refer to the IEC 60086-2 standard (p17)			Radio
						Motor/toy
						Personal cassette player and tape recorder
						CD/MD/Electronic game
						Photo flash
						Digital still camera
						Remote control

Discharge conditions of $20 \pm 2^\circ\text{C}$ and $60 \pm 15 \%$ of relative humidity

Task 1.2 Capacity determination methods

Primary Batteries:

- **IEC 60086 standard**

- **Watch batteries:** IEC 60086-3 defines **two methods** to calculate the capacity in mAh (method A and method B)
- **Specialty batteries** (which are designed for a specific end-use application (e.g. hearing aids, small electronic devices)): IEC 60086-2 defines **a single “service output test”** to measure the capacity/performance for each battery type (can be complemented with additional tests)

Type	Nominal voltage	Discharge conditions			Minimum Average Duration	Applications
		R (kΩ)	Daily period	Cut-off (V)		
BR1225		Please refer to IEC 60086-2(P17-33)				service output test
CR11108						service output test
SR65						service output test

Portable Secondary Batteries

- IEC/EN 60622 (2002) Secondary cells and batteries containing alkaline or other non-acid electrolytes – Sealed nickel-cadmium prismatic rechargeable single cells
- IEC/EN 61951-1 (2004) Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Nickel-cadmium
- IEC/EN 61960 (2003) Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications
- IEC/EN 61056 (2002) General Purpose lead acid batteries (Valve regulated type)



Task 1.2 Capacity determination methods

Portable Secondary Batteries

- Test principle (same for all portable secondary batteries)
 - A continuous discharge **constant current test** allows the determination of **a single rated capacity for each type of secondary cell/battery** in Ampere hours for a specific drainage rate (discharge duration) **typically 5 hours or 20 hours** for end-point voltage of about 1 V.

This is made possible because of the design of rechargeable batteries: **internal resistance of rechargeable batteries is low**, leading to a lower variation in **delivered and rated capacity** in constant current discharge conditions, **and to a lower variation of the rated capacity depending on the end-use application**



Task 1.2 Capacity determination methods

Automotive batteries

The IEC 60095-1 defines methods to determine the:

- **Nominal capacity (ampere hours) – constant current test**
 - The nominal capacity C_n is defined by a 20 hour discharge at constant current with a end-point voltage of 10.5 V (25°C)
- **Cranking performance test – Cold cranking ampere (CCA) (amperes)**
 - CCA is the maximum amperes that can be continuously removed from a battery for 30 seconds at -18 °C before its voltage drops to unusable levels. It characterises the ability to start an engine in cold temperatures (The higher the CCA rating, the greater the starting power of the battery)

STEP 1:

Harmonisation within each category of batteries (primary/secondary/automotive)

- Identification of capacity/performance measurement methods for each type of battery
- Identify sets of batteries having similar tests and where harmonised tests would be necessary (for which comparison is relevant, i.e. batteries of the same format)
- When necessary, and where relevant, reduce the number of capacity/performance evaluation methods for each set of batteries to minimise space requirements on the label

Considerations:

- Test methods should correspond as much as possible to an internationally adopted standard
- Test methods should provide an informative output representative of the battery's range of applications to avoid potential misleading and “unfair competition”

Portable Primary batteries

- Due to battery design, measure of capacity depends on test conditions i.e. end-use application
- The difficulty lies in those batteries with numerous end-use applications
- **Three groups of primary batteries are defined in the standard:**
 - (1) Watch batteries (IEC60086-3)
 - (2) Specialty primary batteries (IEC60086-2)
 - (3) General purpose primary batteries (IEC60086-2)

(1) Portable primary batteries, Watch Batteries:

IEC standard 60086-3 specifies standards for capacity measurement

- Two methods for measuring capacity in mAh
 - Test conditions depend on the nature of the electrolyte, the positive electrode and battery dimensions
 - Test outputs are meaningful and a good basis for comparison
- **BIO proposes to use IEC 60086-3 as a basis for watch capacity marking (recommended method A)**

(2) Portable primary batteries, Specialty batteries

For each specialty battery covered under IEC 60086-3, the standard specifies a service output test.

- Preferred unit for displaying battery performance: service life in hours (easily understandable by customers)
- Single measure based on a long duration reliable test
- Sometimes complemented by a service application test

→ BIO proposes to use the service output test as a basis for capacity/performance marking. Devices development should be monitored so that service application tests can be added if need be.

(3) Portable primary batteries – General purpose batteries

2 steps for harmonisation

- 1 - Identify batteries with similar geometries that can be compared i.e. batteries that can be used in the same devices.



LR6



R6



- 2 – **Harmonisation** of tests for a given geometry in order to enable clear and concise labelling, provided that the information remains meaningful and representative of the battery's performance (**2 approaches**)

Portable primary batteries – General purpose batteries

Harmonisation approach 1:

- When similar tests are identified – select the most representative one
- If the number of tests remains high (above **4 tests**) then it should be reduced down to at a maximum of 4 tests.
- **Selection of the 4 relevant tests:**
 - Application-tests being the most representative of the battery's end-uses
 - Application-tests covering the whole spectrum of applications of the battery (low, medium, and high drain)
 - Complementary information can be displayed on a website
 - **Revision of tests every 5 years (as the IEC tests)**
- Not representative of ALL possible application but covers between 60 ~80 % of most common end-uses and provide a reasonable tool for performance comparison

Task 1.3. Harmonisation of methods

For some geometries, not many tests are defined (<4) – no need to harmonise

For 4 type of geometries, many tests are defined (>4) – harmonisation needed

Number of tests	Battery clusters (similar geometries)	Comments
1	{2R10}	No need to harmonise
2	{4LR61}{3R12S, 3R12P, 3LR12, 3R12C}	No need to harmonise
3	{LR8D425}, {4LR25-2, 4R25-2}, {4LR25-X, 4R25-X}, {4R25Y} {R1, LR1}, {6LR61, 6F22}	No need to harmonise unless some tests are very similar
5	{R14P, R14S, LR14}, {R03, LR03}	Harmonisation needed
6	{R20P, R20S, LR20}	Harmonisation needed
8	{R6P, R6S, LR6}	Harmonisation needed



Primary batteries not (yet) covered by the standard

● Some new technologies have recently been developed on the market leading to new products not yet covered by the IEC standards: some new batteries based on

- Lithium Iron Disulfide (LiFeS_2)
- Nickel OxiHydroxide (NiO_x)

R03 and R6 sizes only

These new products have the same geometry as batteries that are covered by IEC standards and therefore the **same capacity measurement tests should be used**

Portable primary batteries – General purpose batteries

Harmonisation approach 2: (not retained)

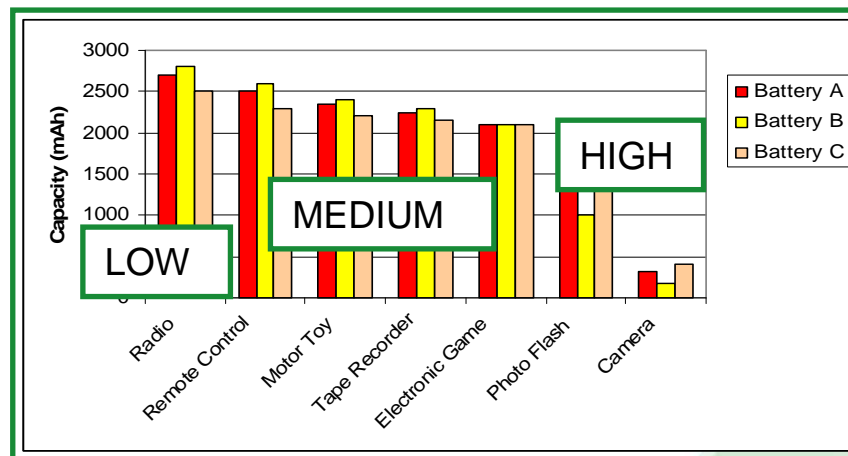
Applications with similar drainage rate (low/medium/high) lead to similar results in terms of capacity = a battery can be reasonably characterised by its capacity in each of these 3 types of applications (low/medium/high drainage rate)

For each battery format:

The number of tests should be reduced down to at a maximum of 3 tests. Selection of the relevant tests for each battery format:

- Select one application test for each drainage rate (Low/medium/high)
- Complementary information can be displayed on a website

LR6



Portable secondary batteries

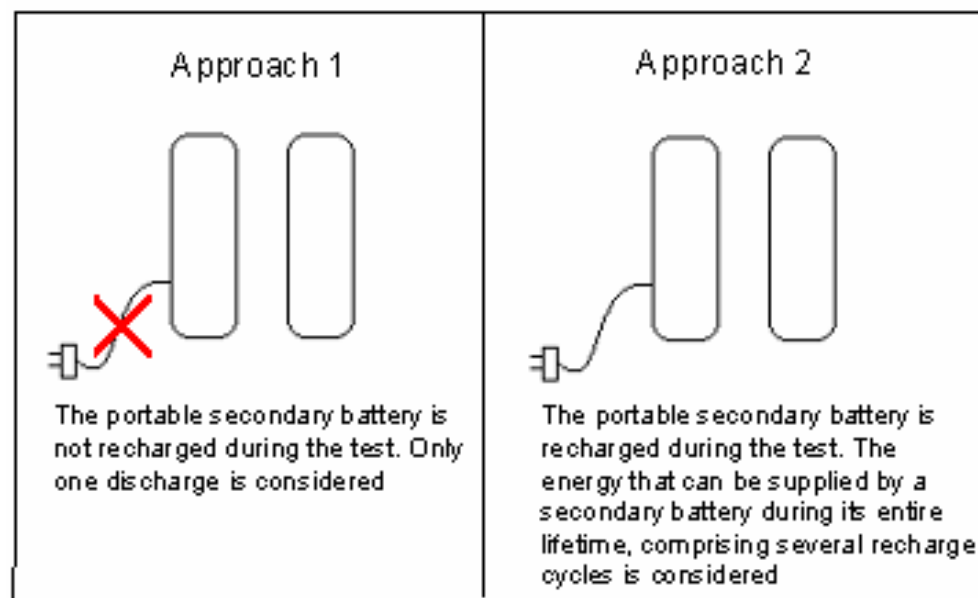
- IEC Capacity tests for secondary Ni-Cd, NiMH, Li and Pb-acid batteries are similar:
 - Tests at constant current
 - Reliable single capacity measurement
 - IEC capacity tests for lead-acid secondary batteries also provide reliable capacity measurement.
- **BIO proposes to keep IEC standards as a basis for capacity marking.**

Automotive batteries

- IEC 60095-1 defines single Capacity value (nominal capacity) and CCA test
- **BIO proposes to keep IEC standard as a basis for capacity marking.**

Harmonisation across categories of batteries (Primary and secondary portable batteries) (STEP 2)

- Is it possible to harmonise testing methods for both primary and secondary batteries which are interchangeable?
- YES: technically feasible. However, such harmonisation would imply departure from IEC standards and **results could be misleading**:
- Two approaches when comparing primary and secondary batteries:





Task 1.3. Harmonisation of methods

Approach 1: Comparison considering **one discharge only** for portable secondary batteries

- Such test would certainly **favour primary batteries** (based on technologies having a higher energy density (kWh/kg of battery))
- Such results would **not reflect the potential economic and environmental benefits that secondary batteries may have compared to primary batteries.**

Secondary batteries are intended to be recharged and “refilled” with energy ⇔ it is **restrictive to only take into account the performance they are able to deliver in one single discharge** as they are **not intended to be used this way**

→ A second approach, which takes into account the ability of secondary portable batteries to be recharged, needs to be considered in order to avoid **misleading evaluations**

Approach 2: Comparison considering total charge-discharge cycles a secondary battery can perform over its life cycle

- Technically feasible, however,
 - **The delivered service-hours by a secondary battery will always outperform primary batteries**
- **Different systems:**
 - [secondary battery + battery-operated device + charger + external power resource]
 - [primary battery + battery-operated device]

→ **Cannot be compared using a single indicator on the performance**

- Comparison only based on the performance indicator would be **incomplete and potentially misleading**

For example, in a clock, a primary battery can provide a satisfactory service life of at least two years, and in such low energy demanding applications, the use of a typically more expensive secondary battery, which also requires the use of a charger, might not be the best choice (the secondary battery “auto-discharge”)

→ A more **global approach** needs to be adopted in order to have a relevant comparison. However, such an analysis is **out of the scope** of the present study which focuses on the capacity of batteries in ampere-hours and on their performance in service-hours over the use phase, and not on their overall environmental performance over their entire life cycle

Compliance requirements associated to each test method were also defined in terms of:

- Sample size (number of batteries tested)
- Choice of the displayed data (e.g. average of sample, minimum value in sample)
- Timing of the measurement (e.g. delayed performance after one year of ageing)
- Data accuracy (e.g. number of digits displayed, accuracy level)

Where such information was available in the IEC standards, the same requirements were recommended. Where no such data was available, the study made suggestions (i.e. for primary batteries).



Task 1 Definition of harmonised methods

General Conclusions for Task 1

- Proposed harmonised methods are based on existing IEC methods which are widely accepted in Europe
- For some batteries (i.e. portable secondary batteries, automotive batteries, primary portable watch and specialty batteries) the capacity/performance can be rated through one single value measured by an IEC/EN standard and there was no need to harmonise the tests
- For some primary general purpose batteries where there exist a large number (i.e. >4) of application tests then a thoughtful selection was necessary to identify the 1-4 most relevant tests
- Compliance requirements are based on IEC standards where data is available

Task 2.1. Capacity Unit

Category of battery	Type of battery	Information	Unit	Main reference
Primary battery	General purpose primary batteries	Performance in a selected number of end-applications (up to 4 data)	Service hours per end-use application or number of pulses The unit is as defined in the IEC application tests	IEC/EN 60086
	Specialty batteries	Performance (single)	Service hours The unit is as defined in the IEC application tests	IEC/EN 60086
	Watch batteries	Capacity (single)	Ampere-hours mAh	IEC/EN 60086
Portable Secondary batteries	Standardised format	Capacity (single data)	Ampere-hours mAh or Ah	IEC/EN 61951/61960/61056/ 60622
	Custom-made batteries	Capacity (single data)	Ampere-hours mAh or Ah	IEC/EN 61951/61960/61056/ 60622
Automotive batteries	Automotive batteries	Capacity (single data) and Performance (single data)	Ampere-hours for the capacity and Amperes for the cranking current	IEC/EN 60095

Labelling options

Detail different labelling options proposed for:

- Portable primary batteries
- Portable secondary batteries
- Automotive batteries

For each labelling option, the study defines:

- Label design
- Label size (not presented here)
- Label location




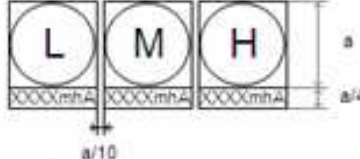

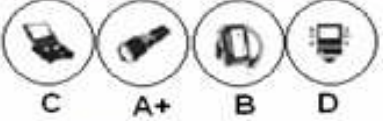

“Two level” approach

- **First level:** “straightforward” labelling approach (based on outputs from capacity/performance tests)
- **Second level:** more elaborate labelling options (based on the EU energy label) which necessitate further research will be presented.




The proposed options were analysed

- **Comparison of the options according to the following criteria:**
 - Technical issues
 - The completeness of the label (capacity, end-use applications, etc.)
 - Interface issues
 - The size of the label
 - The location of the label
 - Readability by the end-user
 - Comprehension by the end-user
- **This allowed identifying the most relevant options to recommend**

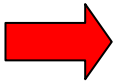
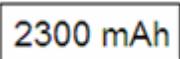
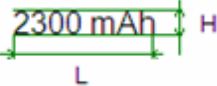
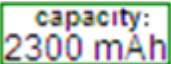
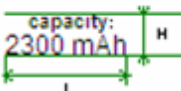
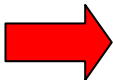

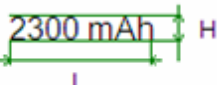
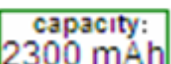
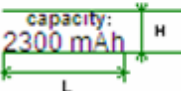
Labelling options – Portable primary batteries:

Battery type	Option	Label design and location	Size	Additional mandatory data	Additional optional data
Portable primary general purpose batteries sold individually	First level Option 1	 <p>XX h XX h XX h XX pulses</p> <p>Front packaging</p>	 <p>$a \geq 10 \text{ mm}$</p>	Manufacturing date on battery	Manufacturer's website address on battery or on packaging
	Option 2	 <p>XXXXmAh XXXXmAh XXXXmAh</p> <p>Front packaging</p>	 <p>$a \geq 10 \text{ mm}$</p>	Manufacturing date on battery	Manufacturer's website address on battery or on packaging
	Option 1a	 <p>Front packaging</p>	As described in Option 1 for primary general purpose portable batteries	Manufacturing date on battery	Manufacturer's website address on battery or on packaging
	Second level Option 1b	 <p>C A+ B D</p> <p>Front packaging</p>	As described in Option 1 for primary general purpose portable batteries	Manufacturing date on battery	Manufacturer's website address on battery or on packaging
	Option 1c	 <p>XX pulses XX h XX h XX h</p> <p>Front packaging</p>	As described in Option 1 for primary general purpose portable batteries	Manufacturing date on battery	Manufacturer's website address on battery or on packaging

Labelling options – Portable primary batteries:

 Portable primary specialty batteries	Option 1	38 hours			
	Front packaging		Minimum size of the label = 12. mm x 5. mm (length x height) to ensure proper visibility.	Manufacturing date on battery	Manufacturer's website address on battery or on packaging
 Portable primary watch batteries	Option 2	Performance: 38 h			
	Front packaging		Minimum size of the label = 22. mm x 5. mm (length x height) to ensure proper visibility.	Manufacturing date on battery	Manufacturer's website address on battery or on packaging
 Portable primary watch batteries	Option 1	45 mAh			
	Front packaging		Minimum size of the label = 12. mm x 5. mm (length x height) to ensure proper visibility.	Manufacturing date on battery	Manufacturer's website address on battery or on packaging
 Portable primary watch batteries	Option 2	Capacity: 45 mAh			
	Front packaging		Minimum size of the label = 22. mm x 5. mm (length x height) to ensure proper visibility.	Manufacturing date on battery	Manufacturer's website address on battery or on packaging

Labelling options – Portable secondary batteries

 Portable secondary batteries: Individual cells	Option 1			N/A	Manufacturer's website address on battery or on packaging
	Option 2			N/A	Manufacturer's website address on battery or on packaging
 Portable secondary batteries: battery packs	Option 1		 <p>Minimum recommended size is 1.5 % of the largest side of the battery pack, and up to .100.mm x 20. mm.</p> <p>Where the size of the battery pack is such that the label is smaller than 2. mm x 5. mm, the battery pack does not need to be marked but the capacity of the battery is recommended to be communicated on their packaging (for replacement battery packs which are sold individually) or on the packaging of the equipment the battery is provided for</p>	N/A	Manufacturer's website address on battery or on packaging
	Option 2		 <p>Minimum recommended size is 1.5 % of the largest side of the battery pack, and up to .100.mm x 20. mm.</p> <p>Where the size of the battery pack is such that the label is smaller than 2. mm x 5. mm, the battery pack does not need to be marked but the capacity of the battery is recommended to be communicated on their packaging (for replacement battery packs which are sold individually) or on the packaging of the equipment the battery is provided for</p>	N/A	Manufacturer's website address on battery or on packaging

Labelling options – Portable secondary batteries

Portable secondary batteries: button cells and memory batteries sold individually	Option 1	200 mAh	Minimum recommended size is 12. mm x 5. mm (L x H).	N/A	Manufacturer's website address on battery or on packaging
Portable secondary batteries: button cells and memory back-up batteries sold individually	Option 2	capacity: 200 mAh	Minimum recommended size is 12. mm x 6.5. mm (L x H).	N/A	Manufacturer's website address on battery or on packaging

Labelling options – Automotive batteries

Automotive battery	Option 1	44 Ah / 360 A	44 Ah / 360 A H L Minimum size recommended is H = 20. mm and L = 150. mm	N/A	N/A
	Option 2	360 A	Minimum size recommended is H = 20. mm and L = 60. mm	N/A	N/A
	Option 3	Performance ranking: 34	As presented in Option 1 for automotive batteries	N/A	N/A

Exemptions

Article 21.7 of the 2006/66/EC Batteries Directive:

“Exemptions from the labelling requirements of this Article may be granted in accordance with the procedure referred to in Article 24(2).”

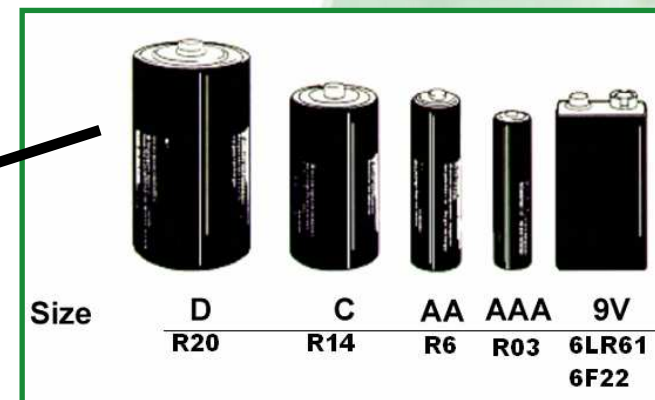
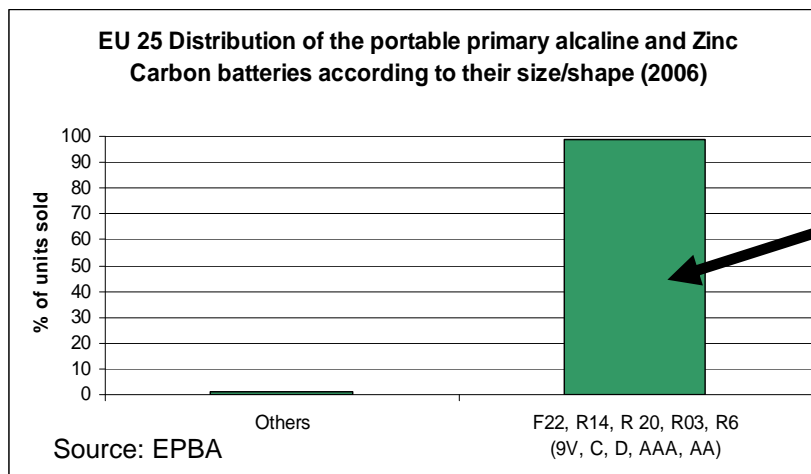
● Exemptions for primary portable batteries

- Recommendation 1: batteries being sold without packaging and with equipment should be exempted from labelling requirements (no buying decision)
- Recommendation 2: Mandatory labelling should be restricted to:
 - batteries of the R6 geometry
 - batteries of the R03 geometry
 - batteries of the R14 geometry
 - batteries of the R20 geometry
 - batteries of the F22 geometry (6F22 and 6LR61)

(I.e. Exemption of watch batteries, specialty batteries, other type of primary general purpose batteries and of portable primary batteries sold without packaging with equipment)

Task 2.2 Label Design and Layout

- These 5 battery geometries make up for 90 % of the primary portable battery market in unit sold annually and over 95 % (possible around 99%) in weight
- Other models of batteries are moreover in decline and not sold across all EU 27 Member States
- A label for comparative purposes is less relevant on the other models of batteries (e.g. button cells, specialty batteries) as these batteries are not widely available on the retail market and are not manufactured by many producers
- Some of the button cell batteries are used as back-up memory batteries and embedded in equipment (not intended to be replaced by the end-user)



- **Exemptions for secondary portable batteries**

- Recommendation: Button cell and memory back-up batteries and battery packs which are supplied embedded (i.e. not intended for replacement by end-user) in equipment should be exempted from labelling requirements

These batteries are estimated to represent 1% (at the most) of the total weight of portable batteries placed on the EU market (about 50 tonnes)

- Exemption will favour a more effective implementation of the capacity labelling requirements for those batteries which represent the major contributors of the environmental impacts
- Exemption will allow limiting the costs for manufacturers (extra costs because labelling limits economies of scale + extra printing processes)

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Conclusions

- No major difficulties for harmonisation of capacity measurement methods of secondary batteries, and specialty and watch primary batteries
- Several options for general purpose primary batteries. The option to retain up to 4 application tests however provides a good basis for product performance comparison
- Labelling options, proposed in a 2 level approach, constitute a tool for the comparison of battery capacity/performance and will allow the end-user to make a informed buying decision. For a more rapid and effective implementation of the labelling requirement some exemptions are recommended, for those batteries which do not represent a significant environmental impact (1% waste stream)

Thank you for your attention!

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