GUIDELINES[1]

ON THE APPLICATION OF COMMISSION REGULATION EU 493/2012 LAYING DOWN DETAILED RULES REGARDING THE CALCULATION OF RECYCLING EFFICIENCIES OF THE RECYCLING PROCESSES OF WASTE BATTERIES AND ACCUMULATORS

1. THE RECYCLING PROCESS

1.1. When does the recycling process start and when does it end?

In accordance with recital (3) and Article 2(1) of Commission Regulation 493/2012 ("the Regulation") the recycling process starts after collection and possible sorting and/or preparation for recycling of the waste batteries and accumulators received by a recycling facility. Thus, the recycling process does not include sorting and/or preparation for recycling/disposal (*see figure 1 below*).

The recycling process ends when output fractions are produced to be used for their original purpose or for other purposes without undergoing further treatment and have ceased to be waste.

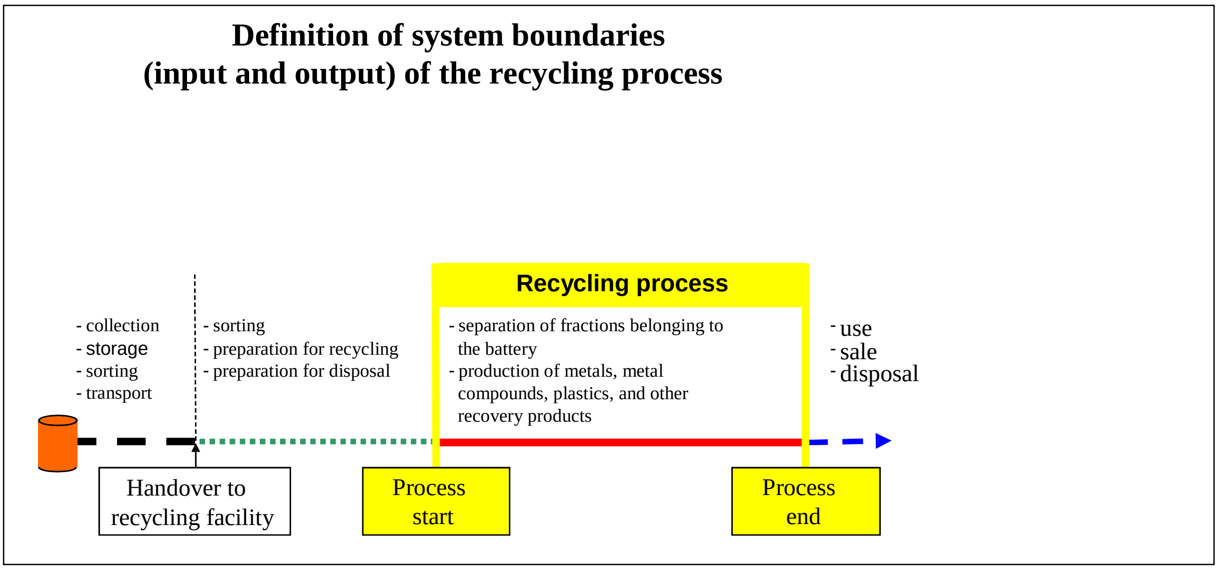


Figure 1: Definition of system boundaries (input and output) of the recycling process of waste batteries

1.2. At what level do the recycling efficiency requirements apply?

The recycling efficiency is to be calculated per recycling process[2], i.e. a process which, either as a standalone process or as part of a sequence, reprocesses waste batteries and accumulators

[1] This guidance document reflects the views of DG Environment and as such is not legally binding. Binding interpretation of EU legislation is the exclusive competence of the Court of Justice of the European Union. The document may be updated as necessary.

for their original purpose or for other purposes (but excluding energy recovery – see the recycling definition in Art 3.8 of Directive 2006/66/EC). A recycling process can be performed at one facility or at different facilities.

The recycling efficiency of a recycling process is to be calculated per year. The continuity, frequency and regularity of input to and output from the process are irrelevant for this calculation.

A recycling facility may have several process lines, usually for different battery types. Each facility must meet the efficiency requirements per year for each process. One recycling efficiency figure per facility is not sufficient if a facility runs more than one recycling process.

In some Member States, several recycling facilities for the same battery chemistry exist (e.g. for lead-acid batteries). These facilities need to calculate the efficiency of their recycling processes individually. Aggregate figures, e.g. the average annual recycling efficiency of all lead-acid battery recycling facilities in one Member State, do not meet the reporting and efficiency requirements.

If the same battery waste stream goes through more than one facility consecutively, the facility where the recycling process commences is regarded as the "first recycler" and is therefore required to calculate the recycling efficiency of the entire recycling process and to submit the information.

1.3. What is preparation for recycling?

Article 2.2 of the Regulation defines preparation for recycling as the treatment of waste batteries and/or accumulators prior to any recycling process, including, inter alia, storage, handling, dismantling of battery packs or separation of fractions that are not part of the battery or accumulator itself. Examples include the separation of the outer casing of a battery pack or the removal of fluids from the cooling system of an industrial battery.

1.4. What is "breaking" of batteries?

"Breaking" batteries constitutes a process of tearing/separating batteries into suitable components or parts which fit the next step in the recycling process. During "breaking" there can be a loss of battery components (e.g. vaporisation of electrolyte). To get a complete mass balance and calculate the recycling efficiency, breaking must be considered as part of the recycling process.

1.5. For which types of batteries does the efficiency of a recycling process need to be calculated?

Three groups of batteries are referred to in the Regulation: lead-acid, nickel-cadmium and "other" batteries.

[2] See Annexes IV, V & VI of the Commission Regulation 493/2012

Wherever a facility recycles subgroups of "other" batteries separately (for example lithium batteries), the recycling efficiency requirements apply to the specific process. In these cases, one recycling efficiency figure for all "other" batteries recycled in one facility through several processes does not meet the reporting and efficiency requirements.

In cases where two or several types of "other" waste batteries are processed together in one line (e.g. AlMn and ZnC or NiMH and Li-Ion), the recycling efficiency of this process will be calculated on the basis of the average input and output composition. However, it has to be ensured that waste batteries which are more difficult to recycle are not mixed and "diluted" with waste batteries of another chemistry.

2. CALCULATING THE RECYCLING EFFICIENCY

2. 1. INPUT FRACTIONS

2.1.1 How to conduct a sorting analysis of waste batteries? (Annex I, point 3, first indent)

Annex I (3) of the Regulation stipulates this can be done through continuous or representative sampling. Sorting in the recycling facility can be done manually, mechanically and/or automatically. The objective of sorting is to decrease the impurity fraction of a dedicated recycling process.

2.1.2. How to determine the chemical composition of waste batteries? (Annex I point 3, second indent)

Annex I, point 3, second indent of the Regulation defines the possible approaches to determine the chemical composition of waste batteries in the input fraction.

For primary batteries the composition range shows a limited variation across various brands and between new and waste batteries. Existing information on the average composition such as, for instance, that published by the European Portable Battery Association (EPBA) could be used[3].

For rechargeable batteries the composition range is not fixed. Therefore, each individual recycler shall conduct a representative sampling.

For industrial batteries product specific information from the producers could be used.

In all cases, the recycler is free to analyse a representative sampling in order to evaluate the average composition of the input fraction.

[3] EPBA: "Product information – primary and rechargeable batteries" http://www.epbaeurope.net/EPBA_product%20information_may2007_FINAL.pdf

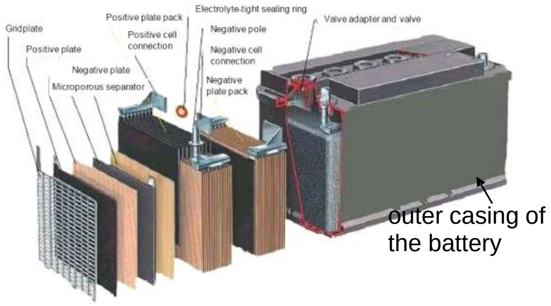
2.1.3. How to distinguish "external jackets" from "outer casings"? (Annex I, point 6, second and third indents)

The external jacket of a battery aims to ensure its mechanical integrity and proper functioning. Once the external jacket (or part of it) is removed, a battery cannot function anymore.

While the external jacket is part of the battery (and its recycling can be accounted for when calculating the recycling efficiency), the outer casing belongs to the battery pack and not the battery itself and cannot be accounted for recycling.

Recycling Efficiency
(external jacket of battery)

- The external jacket of the battery aims to ensure the mechanical integrity of the battery and its proper functioning
- After removing its external jacket/part the battery cannot function anymore



Components of a typical lead-acid battery

Source BIOS [2008]

Figure 2: Explanation of "external jacket" as part of the battery

Recycling Efficiency
(outer casing of battery packs)

- The role of the outer casing of the battery pack is to hold multiple batteries in a single pack
- The removal of an outer casing of a battery pack does not destroy the electrochemical properties of the individual batteries inside the pack

Examples illustrating packs of industrial lead-acid batteries [ESWI 2009]

Figure 3:. Explanation of "outer casing" as a part of the battery pack, not belonging to the battery itself.

2.1.4. How to calculate the mass of outer casings belonging to battery packs? (Annex I, point 6, third indent)

Battery packs are dismantled before recycling and the plastic fraction is separated[4]. The mass of the outer casings of battery packs is excluded and cannot be accounted for recycling; only the cells that enter the recycling process may be accounted for the recycling efficiency.

If battery packs are processed in a hammer mill[5] and the cells are separated from the outer casing, the average contribution by weight of the outer casing is obtained by comparing the weight of separated batteries to the weight of separated outer casings.

If the outer casing is processed together with the batteries (e.g. in a pyro-metallurgical process)[6], the recycler has to perform a sampling in order to evaluate the weight ratio between the outer casing and the cells for several battery packs used in various appliances (e.g. cordless power tool, laptop, mobile phone).

2.1.5. What are "non-targeted" input materials?

There are two kinds of non-targeted materials in the input of a battery recycling process:

a. Materials that are not part of the battery but that enter the recycling process. This might for instance be a small piece of WEEE in which the battery was incorporated (e.g. toys or toothbrushes disposed with the battery incorporated) or the outer casings of battery packs. These materials cannot be taken into account when calculating the recycling efficiency.

[4] This is the case for NiCd and some Li-ion batteries.

[5] A machine whose purpose is to shred or crush aggregate material into smaller pieces

[6] This is the case for Li-ion and NiMH batteries.

b. Batteries that entered the "wrong" recycling process as an impurity, e.g. due to an insufficient or imperfect sorting process. In this case, all batteries (the targeted and non-targeted) in the input of the recycling process should be reported, except for those non-targeted batteries that are taken out prior to entering the recycling operation. The recycling efficiency is calculated on the basis of the total battery input. An example would be Ni-Cd batteries entering a recycling process for Li-ion and NiMH batteries because they were not sorted correctly. Nickel can be recycled but Cd will be waste and cannot be taken into account. Thus the overall recycling efficiency of that process will be lower. Such problems can be solved by better sorting in order to minimize impurities in the input fraction.

2.1.6. Are batteries used in automotive and large industrial applications that consist of various subassemblies batteries or battery packs?

Due to their energy requirements electric vehicle traction batteries consist of more than one cell and other sub-assemblies. As such subassemblies cannot operate as a single unit and cannot provide the energy needed to make electric vehicles function, these batteries should be considered batteries rather than battery packs.

2. 2 OUTPUT FRACTIONS

2.2.1. Should oxygen be calculated? (Annex I, point 5, second indent)

Only the oxygen transferred between input and output fractions should be considered when calculating the recycling efficiency. For instance, in cases where oxygen originating from a battery is transferred to an output product such as a metal oxide, it should be accounted for the recycling efficiency. The oxygen coming from the atmosphere is not accounted for the recycling efficiency.

2.2.2 Should slag that needs further treatment be accounted for? (Annex I, point 5, third indent)

Slag containing battery and accumulator materials can only be accounted for the recycling efficiency if it is suitable and used for recycling purposes as defined in Art. 3(8) of Directive 2006/66/EC. Slag subject to other forms of waste treatment such as energy recovery, landfilling construction or backfilling operations cannot be accounted for in the calculation of the recycling efficiencies.

Interim slag cannot be accounted for the recycling efficiency as it is only an intermediate fraction, not an output fraction at the end of the recycling process. The recycling process of the interim slag has to be followed through to the end of the process chain. The output fractions of the last process steps can be accounted for the recycling efficiency.

2.2.3. Can slag used as construction material be taken into account for the calculation of the recycling efficiency?

Slag used as construction material can be taken into account for the calculation of the recycling efficiency, under the following conditions:

- the slag does not have to undergo any further treatment;
- the slag fulfils the national criteria for use as construction material;
- the slag poses no danger to human health and can be used without harming the environment;
- the slag is not used for landfill construction or backfilling operations.

2.2.4. How to calculate the mass of the input and output fraction on a dry weight basis? How to exclude the water content? (Annex I, points 5 and 6)

Calculating the input and output fraction on a dry weight basis can be done by chemical analysis. For example, the water content of a lead-acid battery is calculated from the density of the acid used in the battery. The density of the acid indicates the ratio between the sulphuric acid and the water content.

3. REPORTING

3.1. Who is responsible for the reporting of the recycling efficiency?

The responsibility for reporting falls on recyclers. Where the recycling process involves more than one facility, the reporting responsibility falls on the *first* recycler. Specialist companies that only undertake the "breaking" of batteries and are acting as subcontractors on behalf of the first recycler without performing further parts of the recycling process should provide relevant information to the first recycler who remains responsible for the full reporting and should still be regarded as “first recycler”.

3.2. To whom shall recyclers report about the achievement of the recycling efficiencies?

Recyclers submit the report to the national authorities of the Member State where they are located. Member States can decide whether reports should be sent to their own national collection system first.

The second, third etc. recyclers have to provide the first recycler with the needed information.

3.3. Is there any other actor to whom recyclers can or should report?

Depending on national legislation recyclers can/should also report the recycling efficiency rates achieved to the supplier of waste batteries.

4. OTHER ISSUES

4.1. What rules apply to recycling operations in another Member State or outside the EU?

As per Article 15 of Directive 2006/66/EC recycling may be undertaken outside the Member State concerned or outside the EU, provided the shipment of waste batteries complies with the EU Waste Shipment Regulation[7]. Furthermore, in case of exports of waste batteries for

[7] Regulation 1013/2006/EC on shipment of waste, OJ L 190, 14.6.2006, p. 1

recycling outside the EU, to count towards the fulfilment of the obligations under the Directive, there needs to be sound evidence that the recycling operation for the exported batteries took place under conditions equivalent to the requirements of the Directive including the recycling efficiencies laid down in Annex III of the Directive.[8]

As regards reporting requirements, in case the (first) recycler is located in another Member State or outside the EU, the recycling efficiency report of that recycler should be submitted to the person who supplied the waste batteries to that recycler. This supplier should then submit the report to his competent national authority.

4.2. What are independent scientific authorities? (Annex I, point 5, first indent)

The selection of the scientific authority certifying that carbon is indeed used as a reducing agent will be the responsibility of the recycler. This scientific authority may for instance be a university or a research institute. It needs to be independent from the recycler and will be fully responsible for the report that it delivers.

[8] A Commission delegated act to lay down criteria for the assessment of such equivalent conditions is under preparation.