EAA

Date: 2013-01-30

PCR

Product Category Rules (PCR) for Aluminium Building Products

PCR developed within the EAA EPD program

Contents

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Introduction

As in EN 15804 but without the first paragraph. In addition:

— This EAA document provides product category rules (PCR) for Type III environmental declarations for the product category of “Products for building applications where Aluminium contributes significantly to the product’s performance characteristics as described in the scope section. This PCR complements the core rules define in EN15804 Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products. Due to copyright issue, extracts from EN15804 cannot be reproduced in this PCR document. The user shall refer then to the original EN15804 to access the relevant extracts which are identified “as in EN15804” in this PCR document.

— This PCR follows the requirements of

  — ISO 21930, Building construction - Sustainability in building construction – Environmental declaration of building products

  — ISO 14025, Environmental labelling and declarations – Type III environmental declarations – Principles and procedures,

  — EN 15804 Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products

  — ISO 14040 series of standards, Environmental management — Life cycle assessment.

— These rules are also compiled to provide the specifications for the verification of

  — a consolidated EPD regrouping a set of products

  — a software tool for generating EPD within the EPD program of the European Aluminium Association.

EPD made in accordance with this PCR are made for Business-to-Business communication.

Declarations based on this PCR are not comparative assertions

1 Scope

This document provides product category rules (PCR) for Type III environmental declarations for the product category of “Products for building applications where aluminium contributes significantly to the product’s performance characteristics“. This PCR covers the following types of aluminium products or aluminium semi-finished products used as structural elements or as part of the building envelop:

- Semi-finished products used as intermediate products, e.g. sheets, composite panels or profiles possibly coated or anodised.
- Windows and doors, including garage doors
- Shutter, shading devices and solar panels
- Curtain walling
- Cladding and roofing
- Balcony and Fences

Other aluminium building products may be covered by the PCR but their coverage needs then to be justified. This PCR does not cover the building internal equipment (e.g. kitchen furniture) and appliances (e.g. washing machine, heating devices.)

EPD developed in accordance to this PCR may also be dynamically generated by a software tool. In practice, this software tool generates EPD from key parameters, including the bill of material, provided by the manufacturer. The software allows then the manufacturer to develop EPDs for their customised products to satisfy the building requirements. This is typically the case for aluminium windows and curtain walls. In such a case, the verification aims at verifying the EPD software tool as well as several EPD samples which are representative of the market.

This PCR also provide rules to developed consolidated EPD regrouping a set of products which fall under the scope of the PCR. Additional requirements regarding consolidated EPD are reported in the normative Annex D.

As in EN 15804 but with the scope restriction as described above.

2 References

EN 15804:2012 and amendment EN 15804 A1

Note: For normative references see chapter 2 in EN 15804

3 Terms and definitions

As in EN 15804

4 Abbreviations

As in EN 15804 and in addition:

EAA - European Aluminium Association

5 General aspects

5.1 Objective of the PCR

As in EN 15804

And in addition specification for additional information in Clause 7.4.3 of this PCR document.

5.2 Types of EPD with respect to life cycle stages covered

As in EN 15804 including the following specification:

The pre-determined parameters of the EPD shall be based on information modules, which comprise at minimum the production stage A1, A2, A3 and the end-of-life operations C1, C2, C3, C4, including information related to the benefits and loads beyond the building system boundary, i.e. module D.

The construction (A4-5) and use stage (B1-7) are optional modules.

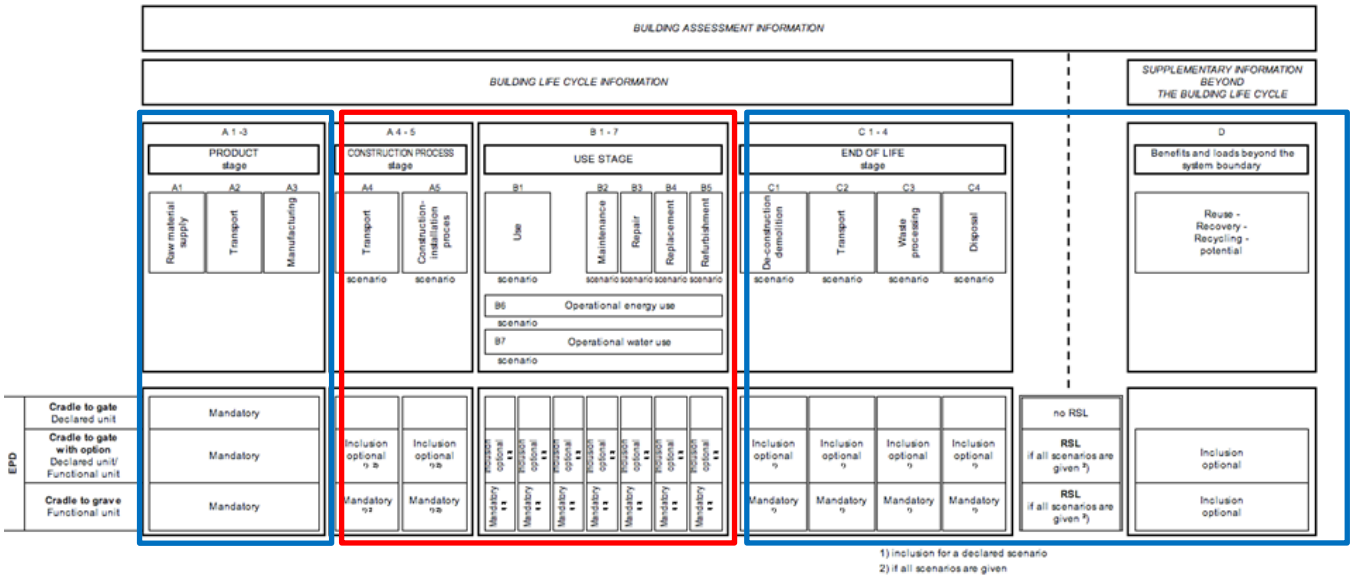


Figure 1 — Mandatory modules in blue frame and optional modules in red frame

5.3 Comparability of EPD for construction products

As in EN 15804 and in addition:

Declarations based on this PCR are not in themselves comparative assertions.

NOTE: If only the mandatory Life Cycle Modules are described in the EPD, then the EPD shall only be used for a comparison in the building context if the function of the compared products is the same and if modules A4 and A5 are equivalent.

NOTE: If the optional modules are described together with the mandatory modules, i.e. the full Life Cycle is described, then the EPD based upon this PCR document can serve as a comparable document with another EPD also fulfilling the requirements of EN15804 regarding comparability.

5.4 Additional information

As in EN 15804 and in addition:

Specification for additional information is found in Clause 7.4.3 of this PCR document.

Note: Because EN 15840 is a frame document it is necessary to specify the additional information.

5.5 Ownership, responsibility and liability for the EPD

As in En 15804

5.6 Communication formats

The communication format is foreseen to be Business-to-Business communication.

The format of the EPD shall address the complete content of the EPD specified in section 7. It can be communicated via hard copy or via electronic media.

For data exchange purposes, the communication format of the EPD shall be in accordance with EN 15942, i.e. for a fixed format of information transfer via the Information Transfer Matrix (ITM).

6 Product Category Rules for LCA

6.1 Product category

The product category referred to in this document is 'Products for building applications where aluminium contributes significantly to the products' performance characteristics'.

See also chapter 1, Scope.

6.2 Life cycle stages and their information modules to be included

6.2.1 General

As in EN 15804

with the additional requirement that modules C1-C4 and module D are mandatory for an EPD following this PCR.

6.2.2 A1-A3, Product stage, information modules

As in EN 15804 and in addition:

The supply structure of the various materials reported in the bill of materials of the product shall be documented and justified and all the respective production, recycling and manufacturing processes shall be described and considered accordingly under Modules A1-A3.

6.2.3 A4-A5, Construction process stage, information modules

As in EN 15804

6.2.4 B1-B5, Use stage, information modules related to the building fabric

As in EN 15804

6.2.5 B6-B7, use stage, information modules related to the operation of the building

As in EN 15804

6.2.6 C1-C4 End-of-life stage, information modules

As in EN 15804

6.2.7 D, Benefits and loads beyond the system boundary, information module

As in EN 15804

6.3 Calculation rules for the LCA

6.3.1 Functional unit

As in EN 15804 and in addition

When the intended use of the building products is known, the functional unit may also be defined at building level, especially when customised products are used to satisfy specific requirements defined at building level. This is usually the case for windows, and curtain walls which are designed according to requirements defined at building level. In these cases, one consolidated EPD may be developed for covering a set of products used within a well-defined building project. In this case, a clear description and inventory of the various buildings products covered by the consolidated EPD shall be provided in the functional unit section as described in the normative Annex D.

6.3.2 Declared unit

As in EN 15804 and in addition:

E.g. 1 window and its specifications, for 40 years

6.3.3 Reference service life (RSL)

As in EN 15804

6.3.4 System boundaries

6.3.4.1 General

As in EN 15804

6.3.4.2 Product stage

As in EN 15804

6.3.4.3 Construction stage

As in EN 15804

6.3.4.4 Use stage

6.3.4.4.1 General

As in EN 15804

6.3.4.4.2 B1-B5 Use stage information modules related to the building fabric:

— **B1 Use of the installed product**

As in EN 15804 and in addition

The simulation of the energy demand during the use phase i.e. cooling and heating demands, can makes sense for products contributing significantly to the building energy performances. It is for example the case for windows or curtain walls. For those products, the contribution of the energy demand to the environmental aspects of the product may be part of the EPD calculation as part of the optional module. In such case, the scenario and the corresponding parameters as well as the simulation tool and methodology, e.g. reference room, climatic zones and orientations, shall be fully documented and provided to the verifier. In the verification report; the verifier shall clearly state the relevance, robustness and transparency of the use phase simulation. The scenario and the corresponding parameters as well as the simulation tool description shall be also documented in the EPD.

— **B2 Maintenance**

As in EN 15804

— **B3 repair**

As in EN 15804

— **B4 Replacement**

As in EN 15804

— **B5 Refurbishment**

As in EN 15804

6.3.4.4.3 B6 – B7 use stage information modules related to the operation of the building:

— **B6 Energy use to operate building integrated technical systems**

As in EN 15804

— **B7 operational water use by building integrated technical systems**

As in EN 15804

6.3.4.5 End-of-life stage

As in EN 15804 and in addition:

See Informative Annex C on the consideration of recycling aspects of aluminium building products for an example.

6.3.4.6 Benefits and loads beyond the product system boundary in module D

As in EN 15804

6.3.5 Criteria for the exclusion of inputs and outputs

As in EN 15804 and in addition:

For hazardous and toxic materials and substances the cut-off rules do not apply.

6.3.6 Selection of data

As in EN 15804

6.3.7 Data quality requirements

As in EN 15804 and in addition:

For the foreground aluminium processes (e.g. aluminium production, aluminium extrusion or aluminium recycling), the EAA LCI datasets, as described in the EAA Environmental profile report [4], should be used. Any deviation to these EAA LCI datasets shall be clearly justified and documented.

Background and generic LCI datasets, e.g. supply of ancillary material and energy or transports, shall be documented and justified.

6.3.8 Developing product level scenarios

As in EN 15804

6.3.9 Units

As in EN 15804

6.4 Inventory analysis

6.4.1 Collecting data

As in EN 15804

6.4.2 Calculation procedures

As in EN 15804

6.4.3 Allocation of input flows and output emissions

6.4.3.1 General

As in EN 15804

6.4.3.2 Co-product allocation

As in EN 15804

6.4.3.3 Allocation procedure of reuse, recycling and recovery

As in EN 15804 and in addition:

See Informative Annex C on the consideration of recycling aspects of aluminium building products for example.

6.5 Impact assessment

As in EN 15804 and amendment EN15804 A1

7 Content of the EPD

7.1 Declaration of general information

As in EN 15804 and in addition:

The information module describing the declared unit or functional unit is illustrated by a flow diagram. (I.e. The production processes shall be described in a flow diagram)

a) As in EN 15804

b) As in EN 15804 and in addition

When the EPD relates to several products, the EPD shall describe the full set of products satisfying the functional unit defined at building level.

c) As in EN 15804 and in addition:

The name and type of product (semi-finished, building element, finished) are stated

Identification of product by product standard or technical approval.

d) – l) As in EN 15804

Table 2 — Demonstration of verification

EAA PCR Aluminium Building Products serves as the PCR [a]
Independent verification of the declaration, according to EN ISO 14025:2010 internal external
(Where appropriate [b]) Third party verifier: <Name of the third party verifier>
[a] Product category rules [b] Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4).

7.2 Declaration of environmental parameters derived from LCA

7.2.1 General

As in EN 15804 and in addition:

In an EAA EPD and based upon this PCR document the Life Cycle Modules

A1, A2, A3, C1, C2, C3, C4 and D are mandatory to describe.

The Life Cycle Modules A4, A5, B1, B2, B3, B4, B5, B6, B7, Are optional to describe.

7.2.2 Rules for declaring LCA information per module

As in EN 15804

In an EAA EPD and based upon this PCR document the Life Cycle Modules

A1, A2, A3, C1, C2, C3, C4 and D are mandatory to describe.

The Life Cycle Modules A4, A5, B1, B2, B3, B4, B5, B6, B7, Are optional to describe.

7.2.3 Parameters describing environmental impacts

As in EN 15804

7.2.4 Parameters describing resource use

As in EN 15804

7.2.5 Other environmental information describing different waste categories and output flows

As in EN 15804

Table 6 shall be consistent with the more detailed information provided under table 12 and with the end of life scenario used to calculate the modules C1 to C4 and the module D.

7.3 Scenarios and additional technical information

7.3.1 General

As in EN 15804

7.3.2 Construction process stage

7.3.2.1 A4, Transport to the building site

As in EN 15804

7.3.2.2 A5, Installation in the building

As in EN 15804

7.3.3 B1-B7 use stage

7.3.3.1 B1-B5 use stage related to the building fabric

As in EN 15804 and in addition:

For products affecting the energy performances of buildings, e.g. doors, windows and curtain walls, the thermal characteristics of the products shall be documented.

In particular for windows and curtain walls, the following characteristics shall be provided

- Dimensions and surface of transparent area;
- Thermal transmittance of the product (W/m2 x K) (in line with the values stated for CE marking);
- Air tightness, consider possible deterioration during life time;

  NOTE: the deterioration of thermal performance when using high performance insulates such as vacuum insulated panels can be quantified and an average figure should be used

- Acoustic performance characteristics;

The simulation of the energy demand during the use phase i.e. cooling and heating demands can make sense for products contributing significantly to the building energy performances. It is for example the case for windows or curtain walls. For those products, the contribution of the energy demand to the environmental aspects of the product may be part of the EPD calculation as part of the optional module. In such case, the scenario and the corresponding parameters as well as the simulation tool and methodology, e.g. reference room, climatic zones and orientations, shall be fully documented and provided to the verifier. In the verification report; the verifier shall clearly state the relevance, robustness and transparency of the use phase simulation. The scenario and the corresponding parameters as well as the simulation tool description shall be also documented in the EPD.

Note: Passive energy gains or losses are reported under B1. Active energy gains or losses are reported under B6.

Fire resistance/reaction to fire: A reference to the harmonised product standards (European Standards EN guiding to the CE marking or the appropriate European Technical Approvals ETAG) can be given.

7.3.3.2 Reference service life

As in EN 15804

7.3.3.3 B6, use of energy and B7, use of water

As in EN 15804

7.3.4 End-of-life

As in EN 15804 and in addition:

If the functional unit or declared unit include aluminium building product(s) composed of several components made of various materials, the table 12 shall be provided for each of these components or materials. In addition, the figures reported in table 12 shall correspond to the flows exiting module C3 and shall then be used to calculate the environmental aspects reported in module D after deduction of the environmental aspects of secondary materials and secondary fuels possibly used in modules A.

In table 12 in EN 15804, disposal shall be specified by type and with requirements for deposition.

7.4 Additional information on release of dangerous substances to indoor air, soil and water during the use stage

7.4.1 Indoor air

As in EN 15804

7.4.2 Soil and water

As in EN 15804

7.4.3 Other additional information

The following aspects shall be documented:

Documentation of aspects of occupational health and safety during production and installation

- Description of occupational health and safety aspects if relevant.
- Special measures for health and occupational protection at the building site during installation, if applicable.

Documentation of environmental aspects

- Special measures for environmental protection at the building site during installation, if applicable.
- Other information relevant for the environment. e.g. use of hexavalent chromium for surface treatment during A1-A3 and relevant for the environment in A5 or in C

External influences

- A short description of alteration of the product during use, caused by external effects as from climate or other wearing influences, e.g.:
  - Cleaning;
  - Thermal shock;
  - Mechanical alteration e.g. from wind.

Special influences

- A short description of possible environmental impacts caused by special influences, e.g.
  - Fire.

7.5 Aggregation of information modules

As in EN 15804

8 Project report

8.1 General

As in EN 15804

8.2 LCA-related elements of the project report

As in EN 15804 and in addition:

The simulation of the energy demand during the use phase i.e. cooling and heating demands, can makes sense for products contributing significantly to the building energy performances. It is for example the case for windows or curtain walls. For those products, the contribution of the energy demand to the environmental aspects of the product may be part of the EPD calculation as part of the optional module. In such case, the scenario and the corresponding parameters as well as the simulation tool and methodology, e.g. reference room, climatic zones and orientations, shall be fully documented and provided to the verifier. In the verification report; the verifier shall clearly state the relevance, robustness and transparency of the use phase simulation. The scenario and the corresponding parameters as well as the simulation tool description shall be also documented in the EPD.

Note: Passive energy gains or losses are reported under B1. Active energy gains or losses are reported under B6.

8.3 Documentation on additional information

As in EN 15804 and in addition:

With amendments from clauses 7.4.1, 7.4.2 and extra clause 7.4.3.

8.4 Data availability for verification

As in EN 15804 and in addition:

The project report/review report is available upon request from: epd@eaa.be

9 Verification and validity of an EPD

As in EN 15804

Annex A
(normative)

Requirements and guidance on the reference service life

As in EN 15804

Annex B
(informative)

Waste

As in EN 15804

Bibliography

As in EN 15804 and in addition:

EN 15804

Environmental Profile Report for the European Aluminium Industry, EAA, latest version available from EAA website

Annex C (Informative)
Recycling aspects of aluminium building products.

1. Introduction: metal recycling and LCA

Two contrasting approaches are generally used to tackle recycling aspects in LCA: the recycled content approach [100:0] and the end of life recycling approach [0:100].

On one hand, the recycled content approach [100:0] uses a cut-off rule for secondary materials or fuels exiting the product system, meaning that any secondary material or secondary fuel flow does not convey any environmental aspect. As a result, this approach considers recycling aspects from the unique production angle, i.e. based on the recycled material used at the production phase of the product. Situated at the beginning of the supply chain, i.e. at the manufacturing stage of a product, this approach neglects the recycling performances of the studied product at the end of its life stage.

On the other hand, the End-of-Life (EoL) recycling approach [0:100] assesses the environmental aspects of secondary materials or fuels leaving the product system based on the corresponding savings of primary material or fuel. This end of life recycling approach considers the recycling rate of the studied product as the key parameter for tackling the environmental aspects of recycling. For metal products, the recycling rate corresponds to the actual amount of metals obtained from recycling with the amount of metals theoretically available at the end of the life of a product, including metal losses during use, collection, scrap preparation and melting. Provided that metal losses during the product use phase are negligible, the end of life recycling rate directly reflects the specific recycling performance of a metallic product independently from market growth or its lifespan. Within the corresponding LCA methodology, the recycling benefits are then calculated based on proven and documented end of life recycling rate, possibly with a correction factor if intrinsic material properties are not fully maintained during recycling.

Even if end of life recycling rate of metal building products is pretty high today, e.g. around 90%-95%, the recycled content in metal building product does not reach on average such a level. In reality, the recycled content is currently limited by the scrap availability which is the bottle neck of the metal supply from recycled metal sources. Indeed, the upper limit of what is recycled today is governed by what was produced in the past. The rapid growth in the use of metals over many years and the fact that metal building products typically have a service life of decades means that there is an actual shortage of metal scrap coming from buildings. As there is insufficient recycled material to satisfy the growing demand, virgin material has to be introduced into the supply chain. Hence, the average recycled content in metal supply is still today relatively limited, usually between 30 and 50%. As an example, the aluminium production in Europe for the year 2010 [1], excluding imports, reaches 4,4 Mt of primary aluminium and 4,3 Mt of recycled aluminium, showing that on average about 50% the aluminium supply comes from recycled aluminium. These figures show that the recycled content grasps inadequately the recycling aspects of metal building products. Thus, the recycled content should be used only to reflect the average share of recycled metal in the overall metal supply chain, i.e. from a “cradle to gate” perspective.

2. Recycling aspects in EN15804

ISO 14044 governing the LCA methodology principles, and the associated ISO 21930 aimed at developing Environmental Product Declarations for building products, recommend applying allocation rules or system expansion in case of recycling. The ILCD handbook [20] is also in line with ISO standards and recommends using the end of life recycling approach [0:100] at least for metal products. However, some standards or guidance documents use the so-called recycled content methodology by applying a cut-off rule on secondary fuels or materials leaving the system. This cut-off rule is also applicable within the modules A, B and C of EN15804 so that the environmental aspects resulting from the end-of-life stage, e.g. re-use, recycling or energy recovery, cannot be reported within the original modules A to C. As a result, these additional environmental aspects are reported in module D. Module D avoids any double crediting or counting since only the net benefits of recycling/recovery are reported, i.e. the recycling/recovery benefits at the end of life minus the recycling/recovery benefits already considered at the production stage. This module D is not restricted to metal scrap but it allows reporting the environmental aspects resulting from the net flow of any secondary material or secondary fuel which exit the building system. By integrating module D in the data consolidation, the LCA methodology corresponds then to the end of life recycling approach [0:100] while excluding module D corresponds to the recycled content approach [100:0].

3. End of life stage for aluminium products: modules C1 to C4

At the end of life stage, aluminium building products are usually inventoried, dismantled and collected in specific containers which are directly sold to metal merchants. These operations of de-construction of aluminium products and collection into specific containers are part of the module C1.

While these end of life aluminium products have already a significant economic value, some processing operations are usually needed before the true recycling process, i.e. melting and casting, can take place. These preparatory operations before recycling shall then be reported under “module C3 waste processing for reuse, recovery or recycling and/or disposal”.

The transport of the end of life aluminium products from the demolition site to the waste processing plant shall then be reported in module C2.

Depending on the size of the pieces and the possible mix with other metals or materials, the preparatory operations consist in fragmenting the product into smaller pieces through cutting, shearing or shredding possibly followed by sorting technologies like magnetic or eddy current separations or sink/float technologies. The next 3 diagrams [3] showed the typical end of life preparatory operations for key aluminium building products before recycling; i.e. remelting or refining.

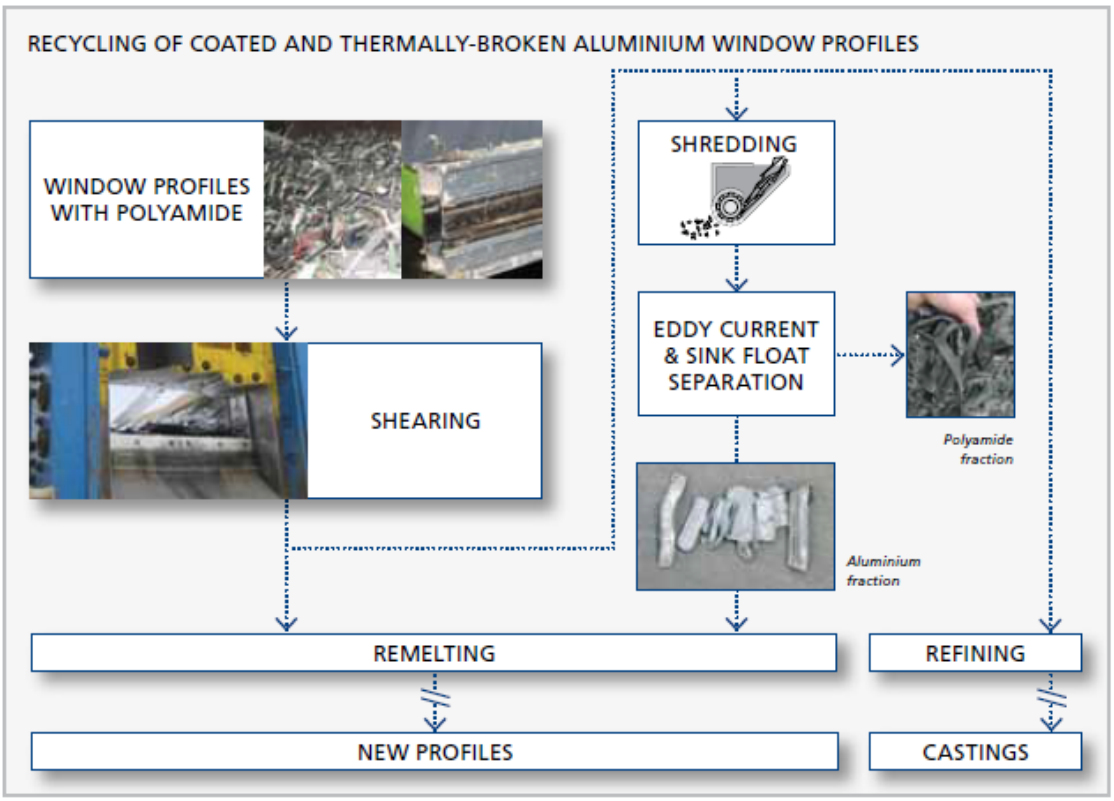


Fig. C.1 – typical recycling route for coated aluminium profiles

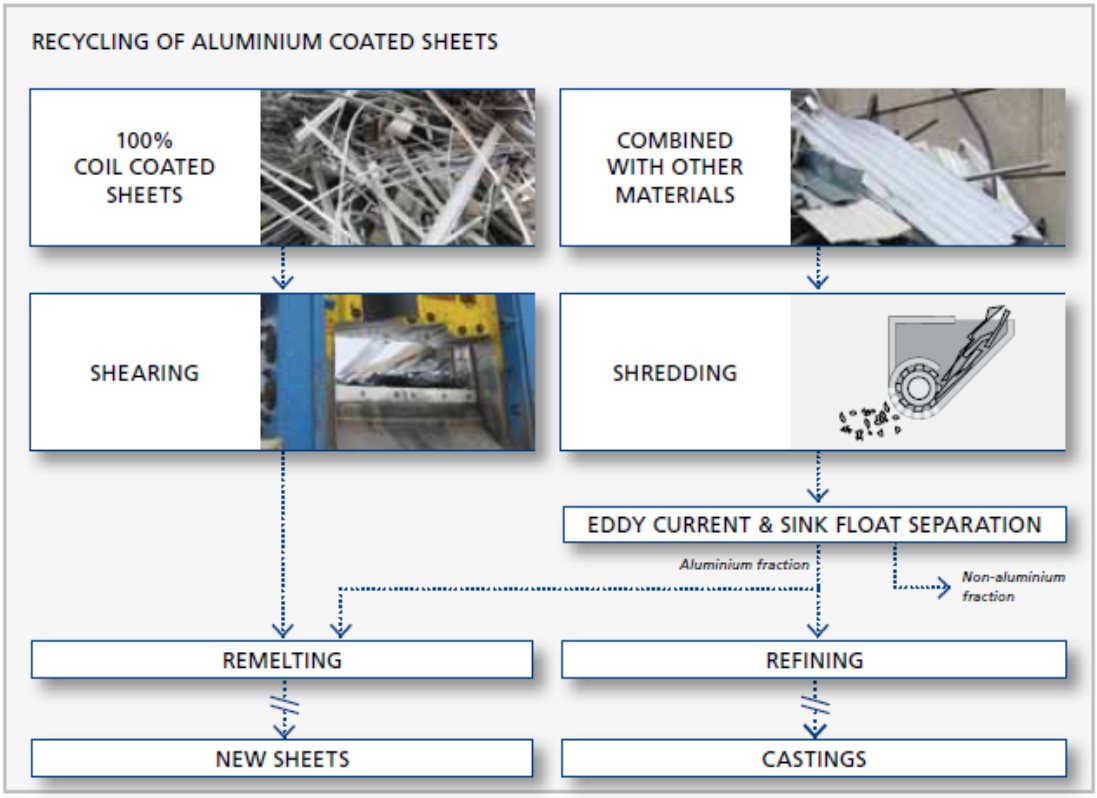


Fig. C.2 – typical recycling route for coated aluminium sheets

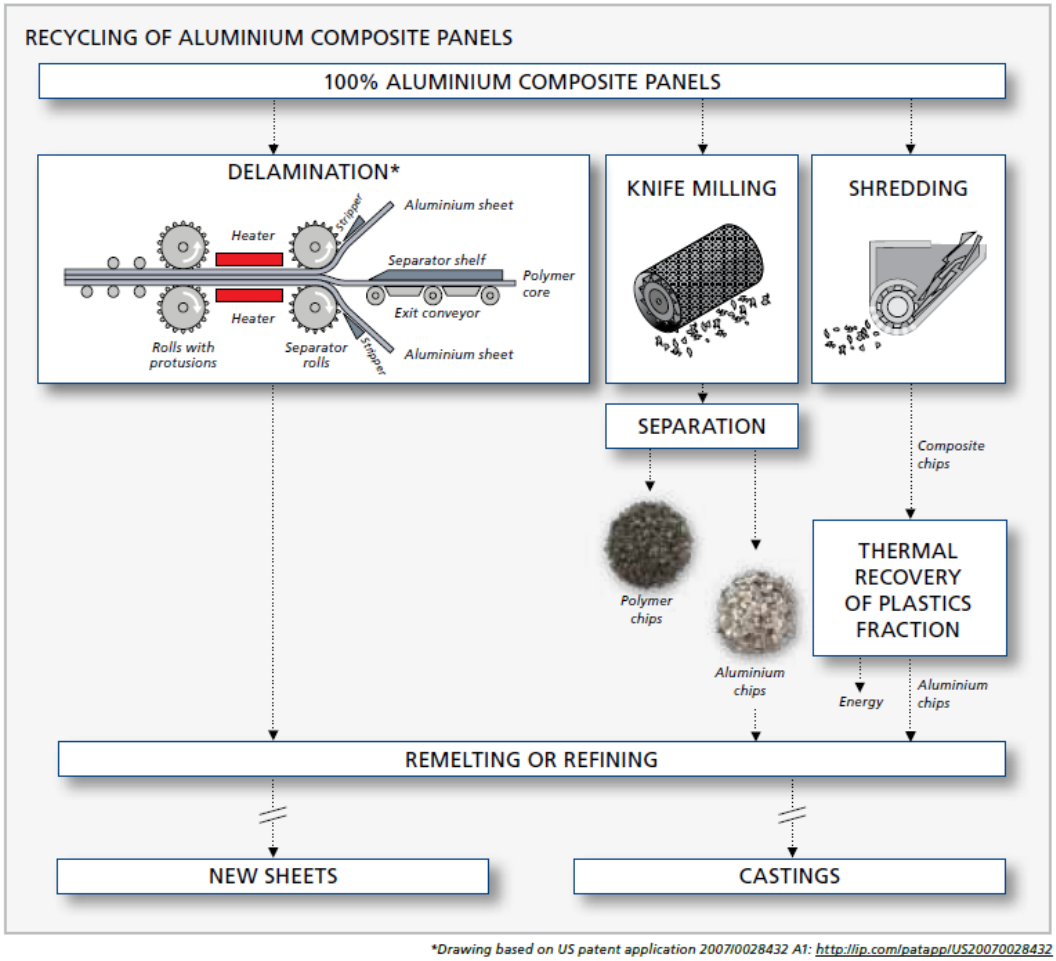


Fig. C.3 – typical recycling route for aluminium composite panels

These mechanical operations aim at preparing various material fractions which can be directly used by material recyclers. In the case of aluminium, the process output is one or several sorted aluminium scrap fraction(s) which can then be directly melted and casted into new aluminium products. These sorted aluminium scrap fractions are secondary materials flows leaving the product system from module C3. As described in section 6.3.4.5 of EN15804, secondary material flow exits the system boundary provided the "end of waste" state is reached, i.e. when the recovered material is commonly used for specific purposes, a market demand is clearly identified and its further use will not have any detrimental impact. Sorted aluminium scrap fractions fully satisfy these criteria. For consistency reasons, recycled metal entering the product system has to respect the same criteria so that secondary aluminium enters the product system as sorted aluminium scrap as well.

4. Aluminium scrap in the building sector

Producing aluminium building products generates aluminium scrap along the production chain, e.g. at the extrusion plant where profiles are produced and cut to usually 6 metre length or at the window manufacturing plant where windows are fabricated. These scrap are mainly composed of short pieces of profiles or sheet coming from cutting operations. A small fraction is composed of scrap from machining operations. These pre-consumer scrap are collected separately and recycled by remelters in order to produce new profiles or sheet. As allowed in modules A1 to A3, these pre-consumer scrap are close-loop recycled through remelting in order to reduce accordingly the supply of metal. Hence, according to this close-loop modelling approach for the production of 1 kg of profile or 1 kg of sheet, a mass of about 1,02 kg of aluminium ingot is required while all the scrap produced along the production chain (usually between 0,2 and 0,4 kg) is remelted. Hence, no allocation rules are then needed in modules A1 to A3 to address the pre-consumer scrap production issue.

In the building sector, profiles are made mostly from EN-AW6060 series while flat aluminium products are mainly composed of the EN-AW3005 alloy. Provided that old aluminium building products are well segregated and prepared as illustrated in previous diagrams, post-consumer aluminium scrap can be directly recycled by remelters to produce new profiles or sheet products.

If the end of life building scrap segregation cannot take place, aluminium scrap from the building sector is then mixed with scrap from other markets. These mixed scrap are not any longer used for wrought aluminium alloys production, i.e. profiles and sheets, but are recycled by refiners who are usually producing cast alloys. In such a case, aluminium scrap is recycled in a "material close loop" system but not any longer in a "product close loop" system.

In "product close loop" system, the intrinsic properties are clearly maintained through recycling so that no correction factor shall be used to reduce the substitution ability of recycled aluminium. In the case of "material close loop" system, the intrinsic properties of aluminium are usually maintained through recycling, even if the application is not identical. If there is however any evidence that these intrinsic properties are not maintained through recycling, the verifier should then secure that an appropriate correction factor is applied to reflect the downgrading which takes place during the recycling process.

The recycling scenario's used in the various modules shall be justified and documented in the LCA report delivered to the verifier and a correction factor shall be applied accordingly in module D in case of downgrading.

5. Module D: the additional environmental aspects from the end of life recycling

This section describes the calculation rules governing module D for an aluminium profile. These rules can be applied to other materials like a steel beam, a plastic products (decorative PVC sectional strip recycled in secondary PVC reused to produce tubes) or wood (energy recovery of wood products) as detailed in a guidance document developed by the French association of building materials (AIMCC) [2].

As described in section 6.4.3.3 of EN15804, Module D aims at assessing the benefits and loads resulting from the net flow of secondary fuels or materials exiting the product system. The environmental aspects of these flows are assessed through system expansion using the so-called "substitution methodology" or "avoided impact" methodology. In such methodology, the secondary material needs to be processed up to the point of functional equivalence where substitution of primary material takes place. In the case of metal, the point of equivalence is the ingot level. Hence, module D calculation needs to consider on one side the burdens of the scrap melting and casting operations while the benefits are reflected by the quantity of primary metal ingot which is effectively saved. If needed, a correction factor may be applied when full substitution cannot take place, i.e. when properties are not maintained through recycling.

Module D assesses the net environmental aspects related to the flows of sorted aluminium scrap entering and exiting the product life cycle. Provided that it can be shown that the aluminium scrap entering the product system have the same properties and composition as the aluminium scrap exiting the system, module D can directly assess the environmental aspects of the net flow of scrap. If this is not the case, module D shall

consider on one side the environmental burdens associated with the scrap input and on the other side shall deduct the environmental benefits resulting from the scrap output.

6. Principle of module D calculation

In this annex, it is assumed that the scrap entering the system and the scrap leaving the system have the same properties so that module D can directly address the next flow of scrap

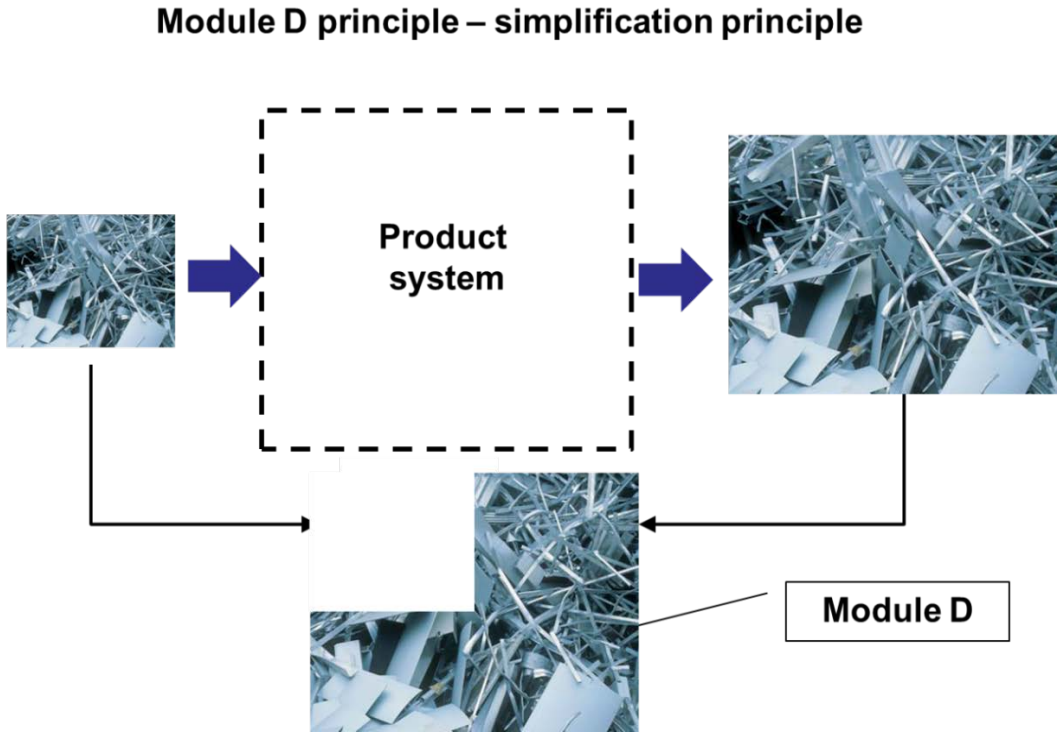


Fig. C.4 simplification of module D calculation principle addressing the net flow of scrap leaving the system

About 40% of the aluminium market supply in Europe (including imports) comes from recycled aluminium. Hence, it is proposed to use this average figure to reflect the metal recycled content of aluminium products used in the building sector. Hence, for 1 kg of profile or sheet, it is assumed that 60% comes from primary aluminium and 40% from recycled aluminium. The EAA has developed LCI datasets on primary production and on recycling which allows calculating the LCI for this production mix.

Already today, more than 95% of the end of life aluminium products used in buildings are collected at end-of-life. As an example, a study [8] performed on several demolition sites in Europe has demonstrated that more than 96% of the aluminium-content of these buildings was selectively collected and sent to processing plants. This study has shown that aluminium big pieces, e.g. sheet or profiles, where systematically collected. Only small pieces, e.g. knobs, internal signage or locking systems, were not collected. Based on this study, a conservative estimate of a collection rate of 96% for aluminium building product is used. The additional losses along the recycling route slightly depend on the preparatory processing operations, e.g. shredding, and the type of melting, e.g. refining vs. remelting. From the end of life aluminium products up to the recycled aluminium ingot, the metal yield is typically comprised between 92% and 98%. As a result, a conservative value of 90% can be estimated for the overall end of life recycling rate of building products, i.e. representing the quantity of recycled ingot in comparison to the theoretically available aluminium in the end of life product. This estimate of 90% is used in the following calculation example. From a mass balance perspective, between 5% to 10% of the aluminium mass is lost, these 10% are lost during the scrap preparation phase where a small fraction of aluminium could follow the ferrous scrap flow directed to the steel industry where it will be oxidised and will be entrapped in the slag or be entrapped with a residue which is either incinerated or landfilled. During the melting process, a small fraction of aluminium can also be oxidised and lost in the dross or salt slag. After treatment, this oxidised fraction, e.g. dross fraction, is usually landfilled. Hence, it can be assumed that the majority of the aluminium losses end in landfills as oxidised aluminium.

1) Calculating the net flow of scrap

Ingot production for module A1 assumes that 40% of the metal supply comes from recycled aluminium. It is assumed that it represents the total scrap input for all the modules, i.e. from A to C. On the other side, it is assumed that 90% of the aluminium material from the End of life products is recycled into a new ingot. It is assumed that it represents the total scrap output. Neglecting the small losses resulting of the melting process, this means that for 1 kg of aluminium used in the product, 0.4 kg comes from aluminium scrap while 0.9 kg will be effectively recycled into a new aluminium ingot, generating an unbalanced flow of aluminium scrap of 0.5 kg, i.e. 50% of the aluminium input.

Hence, module D calculates the aspects of this secondary material flow by considering on one side the burdens of melting and casting this scrap flow and by deducting on the other side the equivalent burdens of the primary ingot production which is avoided thanks to this net flow of scrap issued from the building product.

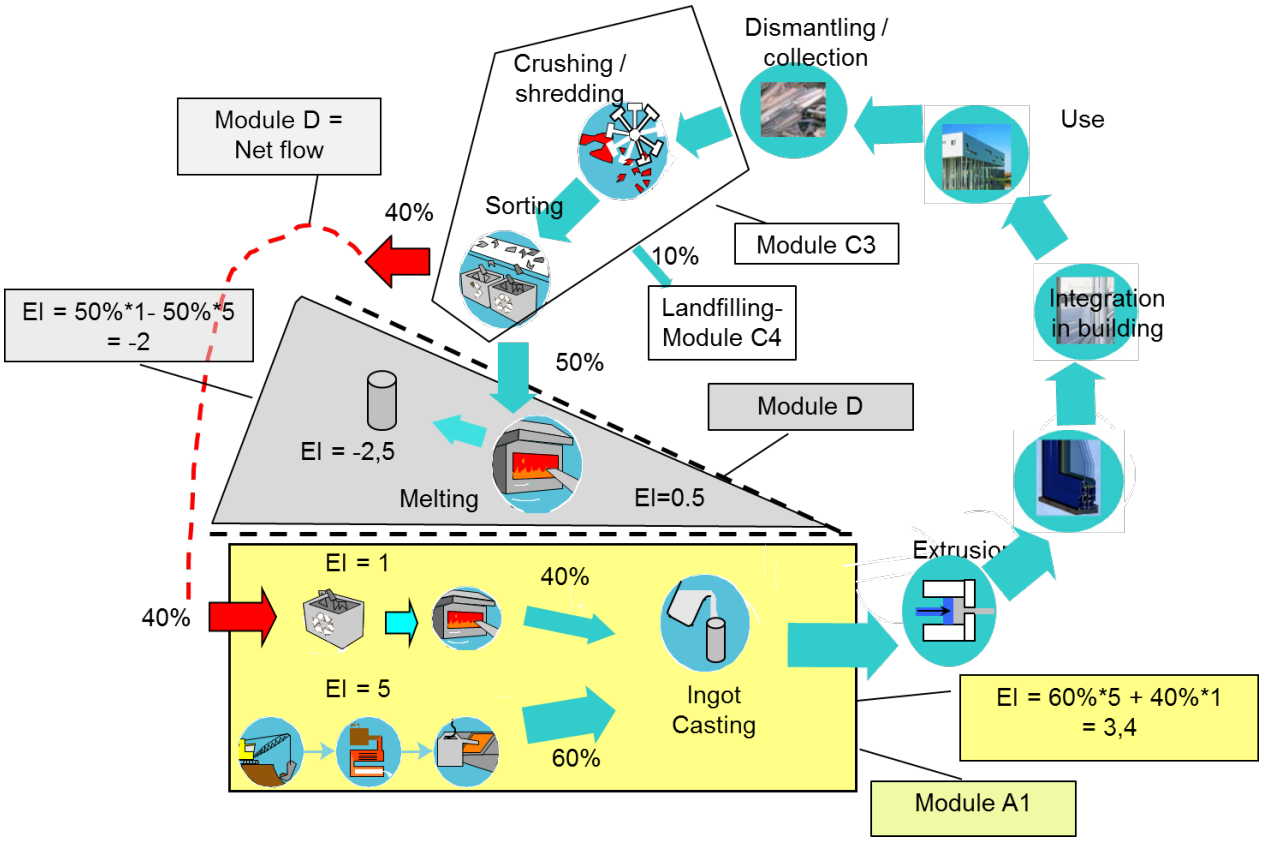


Fig. C.5 typical product life for an aluminium window and associated module D claculation principle

2) Calculating the environmental burdens and benefits of this net flow of aluminium scrap

The calculation principle is demonstrated with a fictive environmental indicator. It is supposed that the value of this environmental indicator is “5” for the ingot production from primary metal and “1” for the production of ingot from recycling

Table C.1.

Ingot origin	Processes covered	Environmental indicator (EI) value
Ingot from primary production	All processes from bauxite mining up to ingot casting	5
Ingot from recycling	Sorted scrap melting and casting	1

Table C.2 reports the calculation principle of module A1 and D based on the previous hypotheses

Table C.2. Calculation principle of Modules A1 and D for the aluminium ingot

Module	Environmental Indicator			Comments
	Recycling	Primary	Total	
A1	40% x 1 = 0.4	60% * 5 = 3	3.4	Metal ingot production based on a recycled content of 40%
D	50% x 1 = 0.5	- 50% x 5= -2.5	-2	Additional benefits from EOL recycling based on a recycling rate of 90%

The aluminium production comes to 60% from ore based production and to 40% from scrap based production. With the environmental impact (EI) of 5 and 1 respectively the average EI for aluminium becomes 3.4 which is reported in module A.

At the EOL stage 10% of the aluminium is lost and 90 % is recycled. Considering that 40% of the aluminium came from scrap at the production stage, an excess of 50% of recycled metal results from the life cycle assessment of the product. Hence, module D assesses the environmental aspects of this flow by considering on one side the burdens of recycling (EI = 50% * 1 = 0.5) and on the other side the benefits of the primary aluminium savings (EI = - 50% * 5 = -2.5). Hence module D give a result of -2 (EI = 0.5 - 2.5 = -2).

In this example, module D results in an environmental benefit since recycling the net flow of aluminium scrap exiting the system generates much less burdens than the corresponding benefits resulting from the avoided ingot production from primary aluminium. This result depends not only on the environmental relevance of recycling for the considered material but also on the difference between the scrap used at the input and output side. In some cases, module D may result in environmental burdens instead of environmental benefits. This case will happen if the product system is a net consumer of valuable secondary material or when the environmental burdens of the recycling processes are higher than the avoided burdens issued from the saved primary production.

7. References for annex C

[1] European Aluminium production statistics, year 2010, available from EAA
[2] Technical guidance for calculating Module D – AIMCC, 2011
[3] Aluminium sustainability in Buildings, EAA brochure, available from EAA website
[4] Environmental Profile Report for the European Aluminium Industry, EAA, latest version available from EAA website
[5] Collection of Aluminium from Buildings in Europe, TU Delft study for EAA, 2004, available from EAA website
[6] Tackling recycling aspects in EN15804: the metal case, paper at the conference on "LCA & Construction", Nantes 10-12 July 2012

Annex D(Normative)**: Additional rules for a consolidated EPD covering a set of products**

Several aluminium building products are designed according the requirements defined at building level. These customised products are non-standardised products. Producing one EPD for each of those products is then time-consuming and unpractical. For those products, the EAA EPD program allows producing one EPD for a set of products instead of producing a separate EPD for each of these products. This consolidated EPD aims at facilitating “B-to-B” communication and the further use of the EPD for assessing the environmental performance of the building itself.

A consolidated EPD shall be used only for aluminium products which are designed specifically for a building project. This is typically the case for windows and curtain walls. For those products, a consolidated EPD can be produced provided that the following additional requirements are satisfied:

- The functional unit is univocally defined
- Each variant of the products included in the consolidated EPD is described. This description shall include at least the typical dimensions including a drawing of the cross section, the total mass and the reference service life.
- If scenarios and additional technical information, as described in section 7.3 of EN15804, are documented, this information shall be provided for each variant of the products included in the consolidated EPD. In particular, data reported according to the various tables reported in section 7.3 of EN15804 shall be detailed for each variant of the products.
- Additional information on release of dangerous substances to indoor air, soil and water during use stage shall also be provided for each variant of the products included into the consolidated EPD.
- An overall bill of material, i.e. list of components and materials constituting the consolidated EPD, contributing for at least 95% of the total mass of the consolidated EPD is documented
- The calculations of consolidated products based on the bill of materials shall include their respective manufacturing processes and be described in Life Cycle Modules A1- A3.

Example: windows for a residential building requiring 20 windows in total

A residential building project requires 20 windows in total.

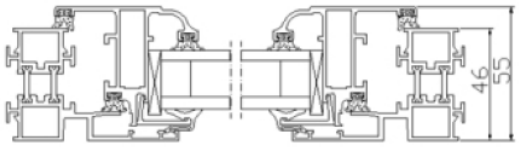
Product type	Nbre of Unit	Dimensions	RSL	Mass per unit in kg	Total in kg
Single tilt and turn window	10	Height = 1.2m * Width: 1.m	40 years	31,7	317
Double window - small	6	Height = 1m * Width: 1.6 m	40 years	44,9	269,4
Double window - Big	2	Height = 1.8m * Width: 1.4m	40 years	67,6	135,2
Horizontal sliding window	2	Height = 2m * Width: 3m	30 years	159,8	319,6
Grand Total	20				1042,2

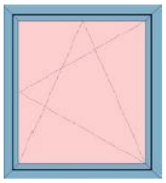
Overall mass of the consolidated EPD: 1042,2 kg (excluding packaging materials)

Description of the various product types included in this consolidated EPD:

1) Single tilt and turn window

One wing with hidden fittings - 46

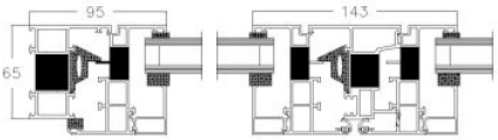


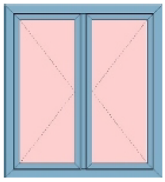


Product characteristics:	
Window size:	
Width:	1,000.00 mm
Height:	1,200.00 mm
Transparent area:	
Transparent Area:	0.92 m²
Surface:	
Surface treatment:	Powder coating
Total weight of the window:	
Mass:	31.67 kg

2) Double window - small

Profile N1

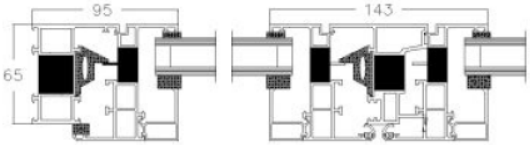


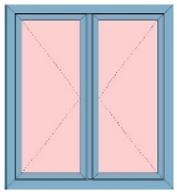


Product characteristics:	
Window size:	
Width:	1,600.00 mm
Height:	1,000.00 mm
Transparent area:	
Transparent Area:	1.02 m²
Surface:	
Surface treatment:	Powder coating
Total weight of the window:	
Mass:	44.86 kg

3) Double window - big

Profile N1

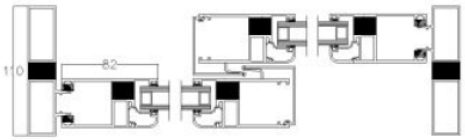




Product characteristics:	
Window size:	
Width:	1,400.00 mm
Height:	1,800.00 mm
Transparent area:	
Transparent Area:	1.70 m²
Surface:	
Surface treatment:	Powder coating
Total weight of the window:	
Mass:	67.60 kg

4) Horizontal sliding window

Generic depth 110



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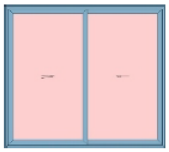

Product characteristics:

Window size:	
Width:	3,000.00 mm
Height:	2,000.00 mm
Transparent area:	
Transparent Area:	5.42 m²
Surface:	
Surface treatment:	Powder coating
Total weight of the window:	
Mass:	159.75 kg

Overall consolidated bill of material (in kg)

Material	Function	%	kg
Galvanized steel	Hardware	1,0%	10,78
Stainless steel	Hardware	0,6%	5,77
Aluminium profiles	Framing	25,9%	269,57
Casted Zinc	Hardware	0,2%	2,37
Casted Aluminium	Hardware	0,3%	2,70
EPDM	Insulation	2,5%	25,82
PA 6.6	Thermal break	3,1%	32,35
Polyester powder	Powder coating	0,5%	5,39
Glass	Double glazing	63,4%	660,49
Others*		2,6%	26,96
TOTAL		100%	1042,20

* Others shall not exceed 5% of the overall mass

Additional materials for packaging

Material	kg
Polyethylene film	15.2
Paper film	5.1
Steel tape for packaging	2.3
Total (packaging)	22.6