ENVIRONMENTAL PRODUCT DECLARATION

in accordance with /ISO 14025/ and /EN 15804/

Owner of the declaration	Gesamtverband der Aluminiumindustrie e.V. (GDA)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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Issue date	13/11/2019
Valid to	12/11/2024

Anodised aluminium profile

Gesamtverband der Aluminiumindustrie e.V.

www.ibu-epd.com / https://epd-online.com

1. General Information

Gesamtverband der Aluminiumindustrie e.V. (GDA)

Programme holder

IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number

EPD-GDA-20190069-IBH1-DE

This declaration is based on the following product category rules:

Products manufactured from aluminium and aluminium alloys, 07/2014
(PCR tested and approved by the independent advisory board (SVR))

Issue date

13/11/2019

Valid to

12/11/2024

Dipl. Ing. Hans Peters
(President of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Executive Director IBU)

Anodised aluminium profile

Owner of the declaration

Gesamtverband der Aluminiumindustrie e.V.
Fritz-Vomfelde-Straße 30
40547 Düsseldorf
Germany

Declared product/declared unit

1 kg anodised aluminium profile

Scope:

This environmental product declaration is based on 1 kg of anodised aluminium profile.

This federation environmental product declaration was compiled on the basis of data from member companies (Aluminium-Laufen AG, Liesberg, apt Extrusions GmbH & Co. KG, apt Extrusions B.V., Hydro Extrusion Nenzing GmbH, OTTO FUCHS KG) and also GSB International.

The production facilities of all companies are located within the DACH region and use the same production technology. Data was collected during one year in either 2016 or 2017.

The owner of the declaration is liable for the basic information and supporting evidence; any liability of the IBU in relation to manufacturer's information, LCA data and supporting evidence is excluded. This document is a translation from German to English. It is based on the original declaration number EPD-GDA-20190069-IBH1-DE.

Verification

European standard /EN 15804/ serves as the core PCR
Verification of the declaration and statements by an independent body in accordance with /ISO 14025:2010/
☐ internal ☒ external

Christina Bocher,
Independent verifier appointed by SVR

2. Product

2.1 Product description/Product definition

The aluminium profiles are semi-finished products for the construction industry, consumer and industrial goods, automotive applications, the solar sector, etc.

The profiles are manufactured from aluminium alloys consisting of the light metal aluminium (Al) and various alloy components (such as silicon, copper, manganese, magnesium etc.).

Depending on customer wishes, the uncoated aluminium profiles can be processed in one or more processing steps before they are worked into an end product.

Surface treatment of profiles: Anodic oxidation

During anodic oxidation (anodising) of aluminium, an artificial oxide layer is produced during an electro-chemical process which has high surface hardness, is wear-resistant and is weather-resistant after compacting. These layers can be coloured by means of tub colouring or electrolytic colouring. The metallic character of aluminium is conserved.

Profiles are anodised in normal production lengths (6 m). The profiles are further processed, for example into windows and façades.

For certain parts or components it is also normal for these to be produced before surface treatment.

Applicable standards for aluminium profiles:
Whether aluminium profiles are subject to harmonisation regulations or not depends on whether they bear a load in the final application (e.g. window frames or supporting beams). However, since the aluminium profiles are semi-finished products, it is not possible to definitively state what the ultimate use for the aluminium profiles will be. For this reason, both standards (profiles and designs in accordance with CPR and profiles which are not subject to any EU harmonisation regulations) are listed in order to cover the breadth of possible final applications for the aluminium profiles.

Profiles and designs in accordance with CPR (hEN):
EU Directive no. 305/2011 (CPR) applies for the putting of this product on the market within the EU/EFTA (with the exception of Switzerland). The product requires a declaration of performance taking into account the following standards:

- /EN 15088/, Aluminium and aluminium alloys - Structural products for construction works - Technical conditions for inspection and delivery
- /EN 1090-3/, Execution of steel structures and aluminium structures- Part 3: Technical requirements for aluminium structures.

The respective national regulations apply to use.

Profiles which are not subject to EU harmonisation regulations:
The respective national regulations apply at the place of application for use of the product.

- /EN 755-1/, Aluminium and aluminium alloys- extruded rod/bar, tube and profiles - Part 1: Technical conditions of delivery
- /EN 12020-1/, Aluminium and aluminium alloys - extruded alloy precision profiles EN AW-6060 and EN AW-6063 - Part 1: Technical conditions for inspection and delivery

2.2 Application

Aluminium profiles are deployed in a wide variety of applications/products. Frequently in construction (for example for windows/façades, solar substructures, ...) but also in consumer goods (for example furniture or household, electrical and sports equipment), in industry (heat sinks and cylinders, ...), in the automotive sector (trim strips, shock absorbers, rear carriers, ...).

2.3 Technical data

Physical properties of aluminium (EN AW-6060):

Constructional data

Name	Value	Unit
Density	2.7	kg/dm³
Melting point	660	°C
Electrical conductivity at 20°C	28 - 34	m/Ωmm²
Thermal conductivity	200 - 240	W/m °C
Coefficient of linear expansion	23.4	µ/C°
Elasticity modulus	70000	N/mm²
Shear modulus	27000	N/mm²
Specific thermal capacity	0.9 - 0.92	kJ/kgK

Profiles and designs in accordance with CPR (hEN):
The product's performance values according to the declaration of performance in relation to its main features in accordance with:

- /EN 15088/, Aluminium and aluminium alloys - Structural products for construction works - Technical conditions for inspection and delivery
- /EN 1090-3/, Execution of steel structures and aluminium structures- Part 3: Technical requirements for aluminium structures.

Profiles which are not subject to EU harmonisation regulations:
The product's performance values in relation to its features according to the main technical regulations (no CE labelling).

2.4 Delivery status

Materials are supplied in accordance with /EN 755-1/ or /EN 12020-1/ .
The chemical composition of alloys is aligned with /EN 573-3/.

The aluminium profiles are packaged in accordance with customer wishes. This includes plastic foil packaging (wrapped) or cardboard spacers.

2.5 Base materials/ancillary materials

The chemical composition of aluminium alloys (threshold values for alloy elements) can be found in the /EN 573-3/ standard. The aluminium content is greater than 90%.

Explanation of material: Aluminium is a light alloy. The melting point of pure aluminium is 660°C. Its natural colour is silvery white.

Aluminium is extremely corrosion-resistant and durable. A natural thin oxide layer protects the material against corrosion by air, water or certain chemicals. Durability is increased further with additional surface protection.

These properties permit the manufacture of profiles with complicated shapes. The material possesses good casting properties, is highly suitable for machining, extremely corrosion-resistant, durable and food safe. Aluminium is both a good thermal and electrical conductor.

Information on surface treatment materials

Different materials are used in the anodising process depending on the desired colour.

For inorganic colouring, the colour pigments are embedded into the pores of the coating (gold and bright colours). For electrical colouring, (copper- or iron-based) metallic salts are permanently attached to the oxide layer within the pores (light bronze to black).

2.6 Manufacture

Heating - The aluminium bolt is heated to 460 °C to 530 °C so that the metal reaches its plastic state.

Extrusion - The hot aluminium bolt is pressed through a pre-heated tool with typical pressing forces of 6,000–8,000 MN/mm2 across the bolt cross-profileal area. The profile is given its geometrical shape in this way.

Cooling - The profiles are cooled directly after extrusion (there are various different processes involving air, water or spray mist). Cooling is necessary for the final hardness.

Stretching - After extrusion, the profiles are stretched to straighten them.

Cutting to length - Cutting of the profiles in accordance with customer requirements (standard 6,000 mm).

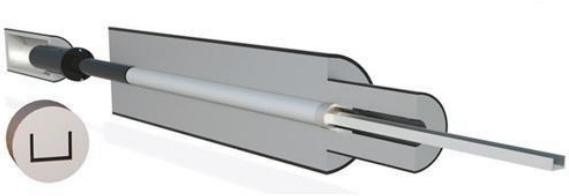
Tempering - Hardening of the profiles at a temperature of between 145 °C and 210 °C (5–12 h)

Packaging - The profiles are then packaged according to individual customer requirements.

Insulation (optional) - Compound profiles with partitions made of materials with extremely bad conductivity can be deployed in order to reduce the thermal conductivity of doors and windows. These often consist of polyamide strips.

Extrusion billets

Tools for hollow profiles



Schematic diagram of the extrusion process – the heated bolt is pressed through a tool

After the extrusion process, the profiles can also be surface-coated and/or processed manually as required.

The entire manufacturing process is monitored by certified quality management systems (such as /ISO 9001/, /IATF 16949/, etc.) with regard to quality-related product requirements.

2.7 Environment and health during use

All statutory obligations with regard to occupational and workplace safety and the environment have been complied with during the entire manufacturing process. This is ensured by management systems (such as /ISO 14001/, /ISO 50001/ and /ISO 45001/) and continuously monitored by accredited certification bodies.

2.8 Product processing/installation

All statutory obligations with regard to occupational and workplace safety and the environment have been complied with during the entire manufacturing process. This is ensured by management systems (such as /ISO 14001/, /ISO 50001/ and /ISO 45001/) and continuously monitored by accredited certification bodies.

2.9 Packaging

All profiles are generally packaged individually according to customer requirements. The packaging materials used range from reusable containers or untreated wooden crates and pallets to cardboard packaging, etc.

The profiles are packaged separately, for example through the use of cardboard separators, polyethylene (PE) foil, paper, etc. to protect the product. The PE foil, paper and cardboard used can be recycled by the purchaser.

2.10 Condition of use
The profiles consist of an aluminium alloy and the specified alloy components. The materials comply with the base materials specified in /EN 573-3/ with the specified mass percentage shares.

There are no specific characteristics regarding the material composition for the period of use.

In the case of surface-coated profiles (colour-anodised or coated) the manufacturer's guidelines for the colours/powder coatings used must be adhered to (for example regarding UV radiation, corrosion-resistance, etc.).

2.11 Environment and health during use
No hazards for water, the air/atmosphere and soil can arise if aluminium profiles are used appropriately.

The requirements for use and maintenance are not based on the semi-finished products produced but the respective specific design and use of the end product.

2.12 Reference period of use
The reference period of use (RSL, reference service life) for aluminium profiles is not declared, as these are semi-finished products for which there are a wide variety of uses.

Their use and corresponding further processing by the manufacturer of the finished product are decisive.

2.13 Extraordinary influences

Fire
Uncoated aluminium profiles fulfil the requirements of building material class A Non-combustible in accordance with /DIN 4102-4/ . The melting point of aluminium is 660°C.

- Flue gas development: No flue gas development occurs with the profiles.
- Flaming droplets/particles: NA
- Toxicity of flue gases: NA

Water
The effect of water on the profiles leads to no change in the product and to no further negative effects for the environment.

Mechanical destruction
Mechanical destruction is not relevant for aluminium profiles.

2.14 End-of-life phase
Aluminium profiles are 100% recyclable. The material does not suffer any loss in quality in the process. Scrap from demolition, conversion or renovation can be easily separated and recycled (via the recycling industry).
All process scrap which accrues during manufacture and further processing in the factory is collected and turned into new primary material (bolts, bars, etc.) in a recycling process in the refining plant. These bolts are reused as new raw material in the works.

2.15 Disposal
The disposal code is aligned to the end product in accordance with the European Waste Catalogue (EWC).

Due to its high value as a raw material, aluminium scrap is not disposed of but recycled in an established recycling process or reused.

Energy consumption during recycling corresponds to just around 5% of the original energy requirement needed to manufacture primary aluminium. No environmental pollution is caused should aluminium actually be disposed of.

2.16 Further information
www.aluinfo.de

3. LCA: Calculation rules

3.1 Declared unit
The declaration relates to an averagely anodised aluminium profile from the company involved in the EPD. The declared unit is 1 kg of aluminium profile.

Specification of the declared unit

Name	Value	Unit
Declared unit	1	kg
Conversion factor to 1 kg	1	-

3.2 System boundary
EPD type: Cradle to gate with options.

The following processes in production stages A1-A3 of aluminium profile manufacturing have been included:

- Provision processes of auxiliary materials and energy
- Transport of the resources and auxiliary materials to the factory
- Manufacturing process for the aluminium ingot (Gesamtverband der Aluminiumindustrie makes available the current European Aluminium Data /EA/)
- Manufacturing process for aluminium profiles in the factory including energy costs, the manufacture of auxiliary materials, disposal of residual materials produced and the inclusion of emissions occurring in the factory.
- Manufacture of packaging (PE foils, cardboard, steel bands and wooden pallets)
- Surface-coating

The following processes in the end-of-life stage are included:

- Shredding the aluminium scrap (C3).
- Costs saved for the net scrap quantity through the substitution of primary aluminium (credit in Module D).

The end of the end-of-waste status is reached after shredding. The shredded scrap is re-smelted into aluminium.
Due to the low environmental influence of the packaging, its disposal was cut off in Module A5 and the end-of-life of the packaging was not included (cut-off).

3.3 Estimations and assumptions

In this study, secondary data from the /GaBi 8 database/ is used in addition to the primary data to model the upstream material and energy flows. This secondary data is as geographically representative as possible.
Since country-specific data is not available for all alloy elements, South African data was used, for example, for ferro-vanadium instead of German/European data as it is the best data available to portray the value-creation chain.
The quantities of alloy elements are, however, very small.
Furthermore, simplified assumptions were made for auxiliary materials, for example that various processing oils and lubricants are summarised under the heading of 'lubricant' in the data.

3.4 Cut-off rules

All main raw materials, thermal and electrical energy used and water were included in the model. Individual auxiliary materials were not included.
In case of inadequate input data or data gaps for a (unity) process, the cut-off rules of 1% of renewable and non-renewable primary energy use and 1% of the total mass of this unity process were adhered to.
The total of ignored material and energy quantities is less than 5% according to mass, energy or environmental relevance. Machines, equipment and infrastructure required for manufacture were ignored.

3.5 Background data

The /GaBi 8/ software system for an integrated approach developed by thinkstep was used to model the life-cycle of the product under examination. The data necessary for the upstream chain for which no specific information is available was taken from the /GaBi 8 database/.

3.6 Data quality

The data for the basic materials is available to a large extent in the /GaBi 8 database/. The database was last updated in 2018. The background data used is less than 10 years old.

The data quality can be regarded as being good. The foreground data has been carefully recorded; all relevant energy and material flows have been included.

3.7 Period under review

The foreground data collected at the manufacturers' premises is based on annual quantities or projections from measurements in specific works. The manufacturing data of the companies represents an average for the years 2016 or 2017.

3.8 Allocation

The necessary quantity of secondary aluminium in manufacturing is first added from aluminium production scrap accruing in the system and end-of-life scrap (closed loop). The net scrap quantity is calculated taking into account various smelting losses for production scrap and end-of-life scrap. A credit is included in Module D for the net scrap quantity (substitution of primary material), taking into account a recovery rate (collection rate and losses) of 96% (/GDA/).
Accruing residual materials and packaging residues are disposed of in landfill.

3.9 Comparability

In principle, a comparison or the evaluation of EPD data is only possible if all data to be compared was compiled in accordance with /EN 15804/ and the building context or product-specific performance characteristics have been included.
The /GaBi 8 database/ was used to model the product lifecycle.

4. LCA: Scenarios and further technical information

The end-of-life for average aluminium profiles consists of 96% recycling and 4% disposal in landfill with the corresponding credits and loads.
Disposal of the packaging in Module A5 was ignored due to its small influence (cut-off).
Module D contains the costs of recovery (re-smelting) and also credits to the value of costs for primary material.
The credits and loads used are based on a Europe-wide average for aluminium scrap and not inherently on the location-specific scrap value of the profiles manufactured.

End-of-life (C3)

Name	Value	Unit
To landfill	4	%

Reuse, recovery and recycling potential (D), relevant scenario information

Name	Value	Unit
To recycling	96	%

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

Production stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA – ENVIRONMENTAL IMPACTS: 1 kg anodised aluminium profile

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2 eq.]	1.07E+1	2.32E-3	-5.51E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11 eq.]	1.09E-10	6.96E-15	-7.74E-11
Acidification potential of land and water	[kg SO_2 eq.]	4.24E-2	8.66E-6	-2.80E-2
Eutrophication potential	[kg $(PO_4)^{3-}$eq.]	3.41E-3	1.06E-6	-1.72E-3
Formation potential for tropospheric ozone photochemical oxidants	[kg Ethen eq.]	2.40E-3	6.19E-7	-1.47E-3
Abiotic depletion potential for non-fossil resources	[kg Sb eq.]	1.48E-5	1.08E-9	5.02E-7
Abiotic depletion potential for fossil resources	[MJ]	1.21E+2	2.66E-2	-5.74E+1

RESULTS OF THE LCA – RESOURCE USE: 1 kg anodised aluminium profile

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	5.16E+1	1.17E-2	-3.12E+1
Renewable primary energy resources as material utilisation	[MJ]	2.95E-1	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	5.19E+1	1.17E-2	-3.12E+1
Non-renewable primary energy as energy carrier	[MJ]	1.40E+2	3.86E-2	-6.78E+1
Non-renewable primary energy resources as material utilisation	[MJ]	4.65E-2	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	1.40E+2	3.86E-2	-6.78E+1
Use of secondary materials	[kg]	2.40E-1	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	1.11E-1	1.61E-5	-7.88E-2

RESULTS OF THE LCA: OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg anodised aluminium profile

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposal	[kg]	1.12E-7	2.92E-10	-3.73E-8
Non-hazardous waste disposal	[kg]	2.45E+0	4.01E-2	-1.58E+0
Radioactive waste disposal	[kg]	7.75E-3	4.76E-6	-4.10E-3
Components for reuse	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	9.60E-1	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0

Technical information: The results for A1-A3 also contain the product packaging. The packaging made of renewable raw materials (wooden pallet and cardboard) encapsulate biogenic carbon dioxide equivalent to 0.02 kg CO^2.

6. LCA: Interpretation

The environmental effects of manufacture are determined by (raw) aluminium production. Here especially, the energy requirement for aluminium electrolysis has a significant influence. This applies to all environmental effects investigated (GWP, OPD, AP, EP, POCP, ADPF) with the exception of abiotic resource use (elements) (ADPE). Here, the manufacture of alloy elements such as copper and zinc have an influence, whereby the share of aluminium in the environmental effects decreases.

7. Requisite evidence

Since the products under examination are semi-finished products, evidence of weathering cannot be brought for the semi-finished products but only for the finished specifically designed and deployed end products.

8. References

/IBU 2016/
IBU (2016): General EPD programme instructions from Institut Bauen und Umwelt e.V. (IBU). Version 1.1, Institut Bauen und Umwelt e.V., Berlin.

/ISO 14025/
DIN EN /ISO 14025:2011-10/, Environmental labels and declarations - Type III Environmental declarations - Principles and procedures.

/EN 15804/
/EN 15804:2012-04+A1 2013/, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

/DIN 4102-4/
DIN 4102-4:2016-05, Fire behaviour of building materials and building components - Part 4: Synopsis and application of classified building materials, components and special components.

/EA/
Environmental Profile Report, 2018, https://www.european-aluminium.eu/resource-hub/environmental-profile-report-2018/.

/EN 1090-3/
DIN EN 1090-3:2017-03, Execution of steel structures and aluminium structures - Part 3: Technical requirements for aluminium structures.

/EN 12020-1/
DIN EN 12020-1:2008-06, Aluminium and aluminium alloys - Extruded precision profiles in alloys EN AW-6060 und EN AW-6063 - Part 1: Technical conditions for inspection and delivery

/EN 15088/
DIN EN 15088:2006-03, Aluminium and aluminium alloys - Structural products for construction works-Technical conditions for inspection and delivery.

/EN 573-3/
DIN EN 573-3:2013-12, Aluminium and aluminium alloys - Chemical composition and form of semi-finished products - Part 3: Chemical composition and form of products.

/EN 755-1/
DIN EN 755-1:2016-10, Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles - Part 1: Technical conditions for inspection and delivery

/GaBi 8/
GaBi software and database for lifecycle engineering. IABP, University of Stuttgart and thinkstep AG, 2018.

/GaBi 8 database/
Documentation of the GaBi 8 database data for integrated lifecycle assessment. LBP, University of Stuttgart and thinkstep AG, Leinfelden-Echterdingen, 2018, http://www.gabi-software.com/international/support/gabi/gabi-database-2018-lci-documentation/.

/GDA/
Gesamtverband der Aluminiumindustrie e.V. (GDA), http://www.aluinfo.de, 2018.

/IATF 16949/
IATF 16949:2016-10, Quality management system requirements for automotive production and relevant service parts organisations.

/ISO 14001/
DIN EN ISO 14001:2015-11, Environmental management systems - Requirements with guidance on use.

/ISO 45001/
DIN ISO 45001:2018-06, Occupational health and safety management systems - Requirements with guidance for use.

/ISO 50001/
DIN EN ISO 50001:2011-12, Energy management systems - Requirements with guidance for use.

/ISO 9001/
DIN EN ISO 9001:2015-11, Quality management systems - Requirements.

/PCR Part A/
Calculation rules for the LCA and requirements of the project report , Version 1.7, Institut Bauen und Umwelt e.V., www.bau-umwelt.com, 2018.

/PCR Part A/
Product category rules for building products Part B: Requirements of the EPD for aluminium and aluminium alloy products, Version 1.6, Institut Bauen und Umwelt e.V. (IBU), 2017-11.

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