

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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Valid to	12/11/2024

Aluminium profile mill finished

Gesamtverband der Aluminiumindustrie e.V.

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GDA



1. General Information

<p>Gesamtverband der Aluminiumindustrie e.V. (GDA)</p> <hr/> <p>Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany</p> <hr/> <p>Declaration number EPD-GDA-20190068-IBH1-DE</p> <hr/> <p>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))</p> <hr/> <p>Issue date 13/11/2019</p> <hr/> <p>Valid to 12/11/2024</p> <hr/> <p>Dipl. Ing. Hans Peters (President of Institut Bauen und Umwelt e.V.)</p> <hr/> <p>Dr. Alexander Röder (Executive Director IBU)</p>	<p>Aluminium profile mill finished</p> <hr/> <p>Owner of the declaration Gesamtverband der Aluminiumindustrie e.V. Fritz-Vomfelde-Straße 30 40547 Düsseldorf Deutschland</p> <hr/> <p>Declared product/declared unit 1 kg aluminium profile mill finished</p> <hr/> <p>Scope: The environmental product declaration refers to 1 kg of average aluminium profile mill finished. 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.</p> <p>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-20190068-IBH1-DE.</p> <hr/> <p>Verification</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">European standard /EN 15804/ serves as the core PCR</td> </tr> <tr> <td style="text-align: center;">Verification of the declaration and statements by an independent body in accordance with /ISO 14025:2010/</td> </tr> <tr> <td style="text-align: center;"> <input type="checkbox"/> internal <input checked="" type="checkbox"/> external </td> </tr> </table> <hr/> <p>Christina Bocher, Independent verifier appointed by SVR</p>	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/	<input type="checkbox"/> internal <input checked="" type="checkbox"/> external
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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.

Applicable standards:
 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 for inspection and delivery
- /EN 12020-1/, Aluminium and aluminium alloys - extruded precision profiles in alloys 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 characteristics of aluminium (e.g. EN AW-6060), i.e. General instructions on aluminium as a basic material:

Constructional data

Name	Value	Unit
Density	2.7	kg/dm ³
Melting point	660	°C
Electrical conductivity at 20°C	28 - 34	m/Ωmm ²
Thermal conductivity	200 - 240	W/m °C
Coefficient of linear expansion	23.4	µ/C°
Elasticity modulus	70000	N/mm ²
Shear modulus	27000	N/mm ²
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.

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.

2.6 Manufacturing

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-sectional 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.

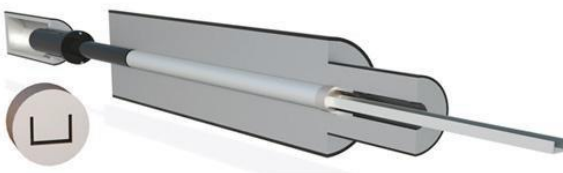
Insulation (optional) - Compound profiles with partitions made of materials with extremely bad conductivity can be deployed in order to reduce the thermal conductivity of doors and windows. These often consist of polyamide strips.



Extrusion billets



Tools for hollow profiles



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

After the extrusion process, 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.

The naturally forming oxide layer on the surface protects the aluminium permanently against weathering.

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 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 average aluminium profile mill finished from the company involved in the EPD. The declared unit is 1 kg of aluminium profile mill finished.

Specification of the declared unit

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

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).

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

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 aluminium profile mill finished

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO ₂ eq.]	8,46E+0	2,32E-3	-5,51E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11 eq.]	1,07E-10	6,96E-15	-7,74E-11
Acidification potential of land and water	[kg SO ₂ eq.]	3,87E-2	8,66E-6	-2,80E-2
Eutrophication potential	[kg (PO ₄) ³ eq.]	2,68E-3	1,06E-6	-1,72E-3
Formation potential for tropospheric ozone photochemical oxidants	[kg Ethen eq.]	2,14E-3	6,19E-7	-1,47E-3
Abiotic depletion potential for non-fossil resources	[kg Sb eq.]	1,23E-5	1,08E-9	5,02E-7
Abiotic depletion potential for fossil resources	[MJ]	9,29E+1	2,66E-2	-5,74E+1

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

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	4,28E+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]	4,31E+1	1,17E-2	-3,12E+1
Non-renewable primary energy as energy carrier	[MJ]	1,08E+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]	1,08E+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]	1,04E-1	1,61E-5	-7,88E-2

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

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposal	[kg]	8,51E-8	2,92E-10	-3,73E-8
Non-hazardous waste disposal	[kg]	2,29E+0	4,01E-2	-1,58E+0
Radioactive waste disposal	[kg]	5,87E-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 0.02kg CO₂.

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

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