ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the declaration	GDA - Gesamtverband der Aluminiumindustrie e.V.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GDA-2019129-IBG1-DE
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Valid to	15/01/2025

Bare Aluminium Sheet

GDA- Gesamtverband der Aluminiumindustrie e.V.

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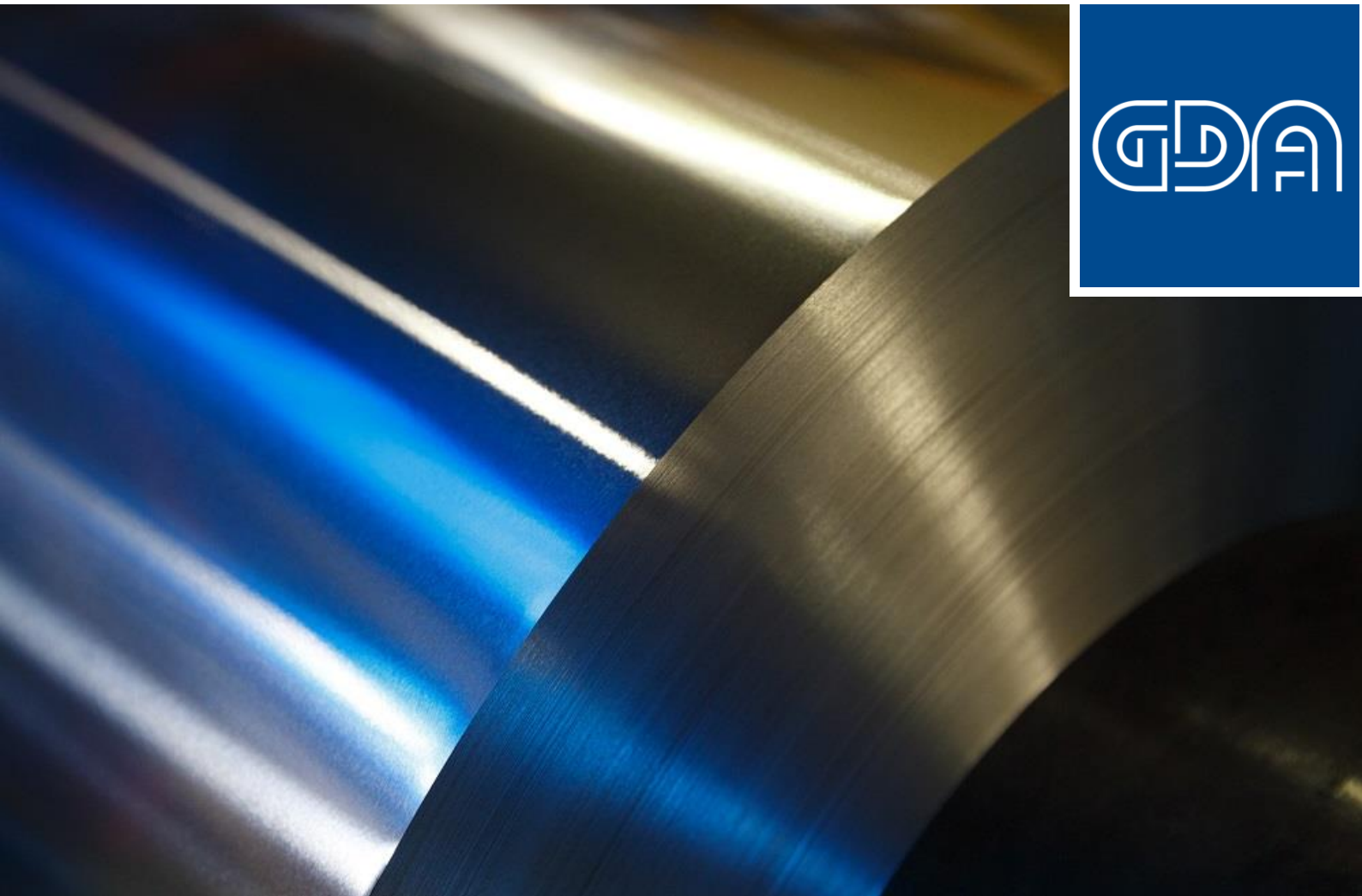

1. General Information

GDA - Gesamtverband der Aluminiumindustrie e.V.

Bare aluminium sheet

Programme holder
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Declaration number
EPD-GDA-2019129-IBG1-DE

Declared product/declared unit
1 kg bare aluminium sheet

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))

Scope:
This document relates to the manufacture of 1 kg of bare aluminium sheet. This EPD was produced on the basis of a European average (EU-28 & Norway, Switzerland, Iceland) of EA (European Aluminium) members. It can be assumed that the representativeness of the data is good due to the comparable production technologies of the individual companies. The data was collected during 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-2019129-IBG1-DE.

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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

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

Dr. Alexander Röder
(Executive Director IBU)

Dipl. Natw. ETH Sascha Iqbal,
Independent verifier appointed by SVR

2. Product

2.1 Product description/Product definition

Bare aluminium sheets are used for applications of all kinds in indoor and outdoor building. The sheets are rolled to the required thickness from aluminium and aluminium alloys and thermally treated according to customer requirements. Various sizes are available.

Since bare aluminium sheets are semi-finished products they are not subject to any EU harmonisation legislation.
The respective national regulations apply to use of the product at the use location, in Germany for example the /building regulations of the federal states/ and the technical regulations based on these regulations.

2.2 Application

The sheets are supplied as semi-finished products and can be adapted for a large number of applications through industrial or manual further processing.

2.3 Technical data

The constructional data presented here is relevant for the product.

Constructional data

Name	Value	Unit
Bulk density in accordance with DIN 1306/	2700	kg/m^3
Melting point /Kammer 2009/	660	°C
Electrical conductivity at 20°C /Kammer 2009/	37.7	m/Ωmm^2
Thermal conductivity /ISO 7345/	235	W/(mK)

Thermal expansion coefficient /ISO 6892-1/	23.1	$10^{-6}K^{-1}$
Elasticity coefficient /ISO 6892-1/	70000	N/mm^2
Specific thermal capacity /ISO 7345/	0.9	kJ/kgK
Yield strength Rp 0.2 min. /ISO 6892-1/	35 - 250	N/mm^2
Tensile strength Rm min. /ISO 6892-1/	100 - 350	N/mm^2
Elongation at break A5 min. /ISO 6892-1/	1 - 30	%

Product performance values in relation to its characteristics are in accordance with the relevant technical purpose (no CE labelling).

2.4 Delivery status

The material is supplied as a semi-finished product in customer-specific dimensions and with customer-specific surface coatings.

2.5 Base materials/auxiliary materials

The most important basic material is aluminium which is obtained by electrolysis from bauxite or from recycling aluminium scrap.
Further basic materials used include alloying elements such as silicon, iron, magnesium and zinc in varying concentrations. The end products contain over 90% aluminium.
Typical aluminium alloys for the construction industry comply with the 3000 and 5000 series in accordance with /EN 573-3/. Approximately 90% water-based alloy-specific synthetic and mineral-based oil emulsions are used as auxiliary materials in the rolling process. These emulsions are maintained in the rlling mill within a closed cycle.

Does the product contain substances which are on the candidate list /(16/07/2019) at a mass concentration above 0.1 %: no

Does the product contain further Category 1A or 1B CMR materials which are not on the candidate list at a mass concentration of above 0.1% in at least one partial product: no

Were biocidal products added to this building product or was it treated with biocidal products (is this therefore a processed product in terms of the /Biocide Product Directive/): no

2.6 Manufacturing

Generally, rolled ingots are cast from the application-specific aluminium alloy using the continuous casting method. These rolled ingots are pushed between two rotating steel rollers which are spaced slightly less far apart than the thickness of the rolled material. The rollers pick it up due to friction and compress it to the distance between the rollers. This forming takes place above all longitudinally so that the rolled material becomes elongated. Several rolling sequences are usually necessary to reach the final thickness. Thermal treatment may be carried out as required to achieve the desired material properties with regard to workability and rigidity.

2.7 Environment and health during use

In recent years, the European semi-finished aluminium goods industry has successfully made great efforts to conserve the environment and resources.
For example, continuous optimisations of the rolling and coating processes make a contribution to resource efficiency (/European Aluminium Association 2018/). 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

The product can be worked using all familiar industrial and manual metalworking processes including sawing, drilling, welding, glueing, riveting, bending and roll forming. Metalworking occupational safety measures must be observed during working. No specific environmental protection measures are necessary when working aluminium sheets. The general work protection and health instructions for building sites apply.

2.9 Packaging

The material is supplied as a rolled coil or sheet metal in the dimensions required by the customer.
Wooden and plastic pallets, plastic films and steel, plastic or paper roll cores are used.
The packaging materials can be reused or recycled after use. Wooden pallets, plastics and paper can therefore be collected separately and recycled. The most frequently used packaging materials are paper and plastic film.

2.10 Condition of use

The condition of use of the material, which is supplied as a semi-finished product, depends on prior treatment by metalworking and installing companies. With appropriate use of the product, no change in material composition either during working or during use is to be expected.

2.11 Environment and health during use

No effect relationships with regard to the environment and health are known if coil coated aluminium sheets are used appropriately.

2.12 Reference period of use

The period of use for many aluminium applications in the construction sector is frequently determined by the building's period of use. Repair and maintenance are minimal due to the self-passivating surface. With appropriate use, a period of use of more than 70 years can be assumed.

2.13 Extraordinary influences

Fire

Aluminium and aluminium alloys comply with building material class A1 according to /DIN 4102/ and /EN 13501/ as well as /Directive 96/603/EC/ and therefore do not make any contribution in case of fire. The melting point of aluminium is 660 °C.

Name	Value
Building material class	A1
Flaming droplets	NA

Flue gas development	None
Toxicity of flue gases	NA

Water
No environmental effects are known of in case of the unforeseen impact of water. Bare aluminium sheets themselves are not affected by water.

Mechanical destruction
All materials remain in a bonded state following mechanical destruction.

2.14 End-of-life phase
The product is not intended to be reused. The material is easily recyclable. After use, the product can be recycled by a specialist aluminium recycling company. The material produced from this recycling can be reused just like primary material. Current data collected by European Aluminium has ascertained an average recycling rate of over 95% for aluminium applications in the construction sector in Germany and the EU.

2.15 Disposal
Aluminium scrap from building applications is an important raw material for future aluminium supplies. The recycling infrastructure is established and available worldwide.

The waste code for aluminium according to the /European Waste Catalogue/ (EAK) is 17 04 02.

The disposal of packaging materials is important for conserving resources. The waste codes for paper, plastic, wood, metal and composite packaging are: 15 01 01, 15 01 02, 15 01 03, 15 01 04, 15 01 05.

2.16 Further information
Further information is available at: www.aluinfo.de.

3. LCA: Calculation rules

3.1 Declared unit
The declared unit relates in each case to 1 kg of average bare aluminium sheet.

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.
This LCA includes the lifecycle stage of product manufacture and also end of life (EoL).

- The product stage covers Module A1 (Raw materials provision), A2 (Transport) and A3 (Manufacture).
- The EoL includes environmental effects which occur due to waste treatment (material recycling of bright mill aluminium sheet). The quantity of aluminium which is recycled (material for recycling, MFR) is declared in C3. The material losses assumed are balanced out in C4.
- Credits from reuse, recovery and recycling potential are shown in Module D in accordance with /EN 15804/.

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
It is assumed that the aluminium ingots are transported a distance of 350 km to the place of manufacture. This assumption is based on empirical values from the Federation.

3.4 Cut-off rules
All operating data collected was included in the balance. Processes whose total contribution to the final result by mass and in all impact categories examined is less than 1% were ignored. It can be assumed that the ignored processes contribute less than 5 % each to the impact categories included.

3.5 Background data
The /GaBi 8/ software system for an integrated approach developed by thinkstep was used to model the life-cycle for the manufacture of the uncoated aluminium sheet. The consistent data in the /GaBi database/ is documented and can be viewed online at http://www.gabi-software.com/international/support/gabi/gabi-database-2018-lci-documentation/.

The base data in the /GaBi database/ was used for energy, transport and auxiliary materials.

3.6 Data quality
The data collected by the members of European Aluminium (EA) from the production year of 2015 was used to model the aluminium upstream chain. All other relevant background data was taken from the /Gabi 8/ database and is not more than 5 years old.

3.7 Period under review
The data basis for this LCA is based on data collected in 2017. The period under review is 12 months.

3.8 Allocation
The quantity of scrap required for manufacturing is first deducted from the aluminium scrap accruing in the system from production and in end-of-life. The system's net quantity of scrap is thus calculated, i.e. the quantity of scrap which exceeds the system boundary.
This results in a credit with primary material less the costs for re-smelting. This credit (substitution of primary material) is assigned to Module D taking into account a recovery rate (recycling rate 90 %).

3.9 Comparability
In principle, a comparison of 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- database/ was used to model the product lifecycle.

4. LCA: Scenarios and further technical information

The end-of-life for average aluminium sheets consists of 90 % recycling and 10 % 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 specific scrap value of the aluminium sheets manufactured.

End-of-life (C4)

Name	Value	Unit
To landfill	10	%

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

Name	Value	Unit
Recycling rate	90	%

5. LCA: Results

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

Production stage			Construction process stage		Use stage							End of life stage				Credits 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	X	X	X	X

RESULTS OF THE LCA – ENVIRONMENTAL IMPACTS: 1 kg bare aluminium sheet

Parameter	Unit	A1-A3	C2	C3	C4	D
Global warming potential	[kg CO_2 eq.]	5.04E+0	5.94E-3	0.00E+0	1.59E-3	-3.77E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11 eq.]	6.93E-11	1.63E-16	0.00E+0	3.55E-16	-5.30E-11
Acidification potential of land and water	[kg SO_2 eq.]	2.51E-2	2.48E-5	0.00E+0	9.43E-6	-1.92E-2
Eutrophication potential	[kg $(PO_4)^{3-}$ eq.]	1.64E-3	6.33E-6	0.00E+0	1.30E-6	-1.18E-3
Formation potential for tropospheric ozone photochemical oxidants	[kg Ethen eq.]	1.33E-3	-9.26E-6	0.00E+0	7.33E-7	-1.01E-3
Abiotic depletion potential for non-fossil resources	[kg Sb eq.]	2.43E-6	4.91E-10	0.00E+0	6.13E-10	3.44E-7
Abiotic depletion potential for fossil resources	[MJ]	5.37E+1	8.14E-2	0.00E+0	2.06E-2	-3.94E+1

RESULTS OF THE LCA – RESOURCE USE: 1 kg bare aluminium sheet

Parameter	Unit	A1-A3	C2	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	2.74E+1	4.50E-3	0.00E+0	2.65E-3	-2.14E+1
Renewable primary energy resources as material utilisation	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	2.74E+1	4.50E-3	0.00E+0	2.65E-3	-2.14E+1
Non-renewable primary energy as energy carrier	[MJ]	6.31E+1	8.16E-2	0.00E+0	2.14E-2	-4.65E+1
Non-renewable primary energy resources as material utilisation	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	6.31E+1	8.16E-2	0.00E+0	2.14E-2	-4.65E+1
Use of secondary materials	[kg]	4.35E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	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	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	6.94E-2	8.30E-6	0.00E+0	4.08E-6	-5.39E-2

RESULTS OF THE LCA: OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg bare aluminium sheet

Parameter	Unit	A1-A3	C2	C3	C4	D
Hazardous waste disposal	[kg]	5.02E-8	4.72E-9	0.00E+0	3.68E-10	-2.55E-8
Non-hazardous waste disposal	[kg]	1.47E+0	6.84E-6	0.00E+0	1.00E-1	-1.08E+0
Radioactive waste disposal	[kg]	3.69E-3	1.12E-7	0.00E+0	3.05E-7	-2.80E-3
Components for reuse	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	4.52E-1	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

6. LCA: Interpretation

Modules A1-A3 bear the main environmental loads of the lifecycle. Pre-production provision for the manufacture of the aluminium rolled ingots dominates in all impact categories. The influence is to be classified as significant (> 50 %).

Compared to the old EPD from 2013, the global warming potential in the manufacturing phase is significantly reduced as approximately 43 % of secondary material is used in the aluminium composite panels. The environmental effects have been reduced in all further impact categories through the increased secondary share. By contrast, the environmental effects of rolling are insignificant in all impact categories (< 10%).

The credit in the end-of-life results from the material recycling of the aluminium sheet. The energy used for recycling aluminium is up to 95% less compared to primary manufacture.

7. Requisite evidence

The product under review is a semi-finished product. Evidence, for example on weathering, can only be provided for individual specifically designed and used end products, not for semi-finished goods.

8. References

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/Directive 96/603/EG/
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