ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association GDA)
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Blank aluminium sheet

GDA – Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association)

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD EN 15804 VERIFIED

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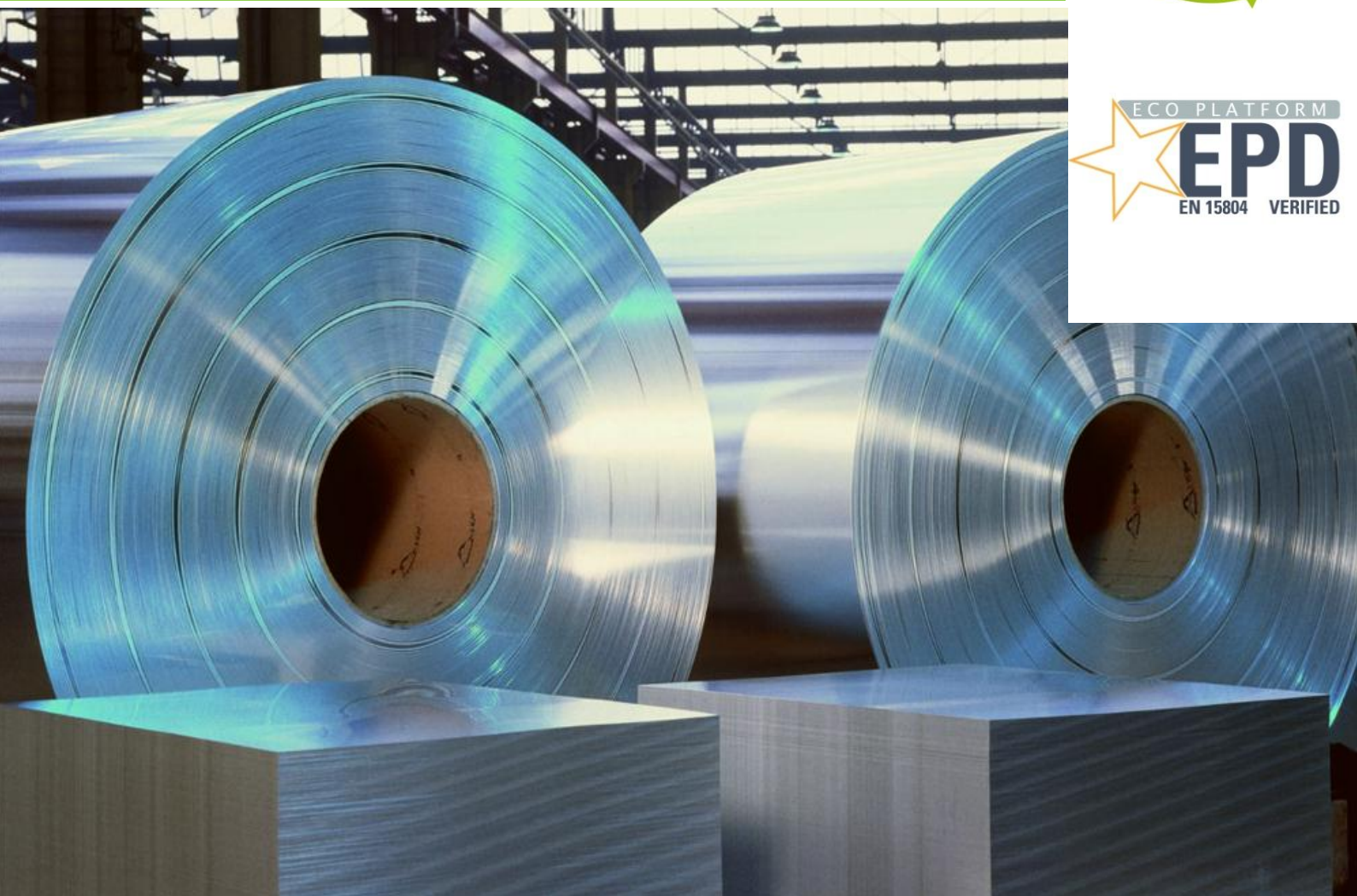

GESAMTVERBAND DER ALUMINIUMINDUSTRIE e.V.

1. General information

Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association GDA)

Blank aluminium sheet

Programme holder

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Declaration number

EPD-GDA-20130258-IBG1-EN

Declared product/unit

1 kg aluminium sheet

This Declaration is based on the Product Category Rules:

Products of aluminium and aluminium alloys, 10-2012 (PCR tested and approved by the independent Expert Committee (SVA))

Area of applicability:

This document refers to the manufacture of 1 kg polished sheet aluminium. The EPD was drawn up on the basis of a European average (EU-27 & Norway, Switzerland, Iceland) of EAA members (European Aluminium Association). On account of the comparable production technologies used by the individual members, good data representativity can be assumed. The data collated concerns the period 2010. Liability by IBU concerning manufacturer's information, LCA data and evidence is excluded.

Issue date

18.11.2013

Valid until

17.11.2018

Verification

The EN 15804 CEN standard serves as the core PCR.

Verification of the EPD by an independent third party in accordance with ISO 14025

☐ internally ☒ externally

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(President of Institut Bauen und Umwelt e.V.)

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(Managing Director IBU)

Matthias Schulz
(Independent verifier appointed by the SVA)

2. Product

2.1 Product description

Blank aluminium sheet for all types of interior and exterior construction applications. The aluminium and aluminium alloy sheets are rolled to the requisite thickness and treated thermally in accordance with customer specifications. Various sizes are available.

2.2 Application

Sheets are supplied semi-finished and can be adapted for a variety of applications by means of industrial or manual processing.

2.3 Technical data

The construction data listed here is of relevance for the product.

Construction data

Description	Value	Unit
Bulk density as per DIN 1306:	2700	kg/m^3
Melting point as per Kammer 2009	660	°C
Electrical conductivity at 20 °C as per Kammer 2009	37.7	m/Ωmm^2
Thermal conductivity to EN-ISO 7345	235	W/(mK)
Linear thermal expansion rate to EN ISO 6892-1	23.1	10^{-6}K^{-1}
Elasticity module to EN ISO 6892-1	70000	N/mm^2
Specific thermal capacity to EN ISO 7345	0.9	kJ/kgK
Yield strength Rp 0.2 min. to EN ISO 6892-1	35 - 250	N/mm^2
Tensile strength Rm min. to EN ISO 6892-1	100 - 350	N/mm^2
Elongation at break A5 min. to EN ISO 6892-1	1 - >30	%

2.4 Placing on the market / Application rules

- DIN 18516-1
- DIN 18807-9
- DIN EN 485-2
- DIN EN 573-3
- DIN EN 1999-1-1
- DIN EN ISO 7599
- DIN 4102
- Directive 96/603/EC
- DIN EN 13501-1

2.5 Delivery status

The material is supplied semi-finished in customised dimensions for further processing.

2.6 Base materials / Auxiliaries

The most significant base material is aluminium which is extracted from bauxite via electrolysis or by recycling of aluminium scrap. Alloying elements such as various concentrations of silicon, iron, magnesium and zinc are used as additional base materials. The aluminium content of end products exceeds 90%. Typical aluminium alloys for the construction sector comply with the 3000 and 5000 series to DIN EN 573-3. Alloy-specific synthetic and mineral oil emulsions with an approx. water content of 90% are used as auxiliaries during the rolling process. These emulsions are managed in a closed loop in the rolling plant.

2.7 Production

Rolling ingots are usually cast from the application-specific aluminium alloy via a continuous casting process. These rolling ingots are slid between two rotating steel rollers which are spaced a little less than the thickness of the rolling pieces. Friction causes entrainment by the rollers and compression to the space between the rollers. This reshaping is primarily lengthwise causing the rolled pieces to elongate. Several rolling processes are usually required in order to obtain the final thickness. Thermal treatment is performed as required in order to achieve the requisite material properties in terms of formability and strength.

2.8 Environment and health during production

Over the past few years, the European semi-finished aluminium products industry has successfully made a great effort in terms of conservation of the environment and resources.
For example: on-going optimisation of rolling processes contributes to efficiency of resources (European Aluminium Association 2013). Technical environment and health management systems are applied prudently and sustainably by most of the semi-finished aluminium products industry. No measures exceeding statutory requirements are necessitated.

2.9 Product processing / Installation

The product can be processed using all known working methods associated with industrial and manual metalworking such as sawing, boring, welding, glueing, studding, bending and roll-forming. The industrial safety measures for metalworking must be maintained during processing. No specific environmental protection or industrial safety measures are required when processing aluminium sheet. The General Information on Industrial Safety and Health (BGI 5081) applies.

2.10 Packaging

The material is supplied as rolled strips or sheet panels in the dimensions specified by the customer. Wooden pallets, plastic foil and roll cores made of steel, plastic or paper are used as packaging materials. After use, packaging materials can be re-used or recycled. Wooden pallets, plastic and paper can be collected separately and directed to the recycling circuit.

2.11 Condition of use

The condition of use of material supplied as semi-finished products depends on previous processing by the metalworking and installation facilities. When the product is used as designated, no changes in material composition are to be anticipated during processing or use.

2.12 Environment and health during use

When aluminium sheet is used as designated, no interactions between the environment and health are known.

2.13 Reference service life

The service life for many aluminium applications in the construction sector is often determined by the service life of the building. Maintenance is low thanks to the self-passivating surface. When used as designated, a service life of more than 70 years can be assumed.

2.14 Extraordinary effects

Fire

Aluminium and aluminium alloys comply with construction product class A1 in accordance with DIN 4102 and DIN EN 13501 as well as Directive 96/603/EC, and do not therefore make any contribution to fire.

Water

No environmental impact is known in the event of unforeseen exposure to water. Sheet aluminium is not sensitive to water.

Mechanical destruction

In the event of mechanical destruction, all substances remain bound.

2.15 Re-use phase

The product is not intended for re-use. The material is easily recyclable. After the use phase, the product can be directed to a specialist company for aluminium recycling. Material produced by these recyclers can be used again as primary material. A current survey by the European Aluminium Association has established an average recycling rate of more than 95% for aluminium applications in the construction sector.

2.16 Disposal

Aluminium scrap from construction applications is a key raw material for future aluminium supplies. The recycling infrastructure is established and available world-wide.
The waste code for aluminium in accordance with the European Waste Catalogue (EWC) is 17 04 02.

2.17 Further information

More information available at:
www.aluinfo.de

3. LCA: Calculation rules

3.1 Declared unit

The declared unit involves 1 kg average polished aluminium sheet.

Declared unit

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

3.2 System boundary

Type of EPD: Cradle to gate – with options
This Life Cycle Assessment takes consideration of the life cycle stages of Production and End of Life (EoL). The product stage comprises Modules A1 (Raw material supply), A2 (Transport) and A3 (Production). Module D depicts the credits from the re-use, recovery and recycling potential in accordance with EN 15804.

3.3 Estimates and assumptions

It was assumed that the distance for transporting aluminium ingots to the production site is 350 km. This assumption is based on empirical values availed of by the association.

3.4 Cut-off criteria

All operating data was taken into consideration in the analysis. Processes whose entire contribution towards the final manufacturing result in terms of mass and less than 1% of all impact categories considered were ignored.
It can be assumed that the processes ignored would have contributed less than 5% to the impact categories under review.

3.5 Background data

GaBi 6 2013 - the software system for comprehensive analysis developed by PE INTERNATIONAL – was used for modelling the life cycle for the manufacture of polished aluminium sheet. The consistent data sets contained in the GaBi data base are documented and can be viewed online. The basic data in the GaBi data base was applied for energy, transport and consumables. The Life Cycle Assessment was drawn up for the reference area EU-27 & EFTA countries (Norway, Switzerland, Iceland). This means that apart from the production processes, the pre-stages also of relevance for EU-27 and EFTA countries such as provision of electricity or energy sources were used.

3.6 Data quality

For modelling the product stage for blank aluminium sheet, the data collated by members of the European Aluminium Association (EAA) for the production year 2010 was applied. All other relevant background data sets were taken from the GaBi 6 software data base and are less than 5 years old.

3.7 Period under review

The data for this Life Cycle Assessment is based on data sets from 2010. The period under review was 12 months.

3.8 Allocation

Of the aluminium scrap generated in the system during production and end-of-life scrap, the required volume of recycled aluminium is redirected to production. If only primary aluminium is used in product manufacturing or more scrap is incurred than can be redirected to recycling, it is assumed that these scrap values have reached end-of-waste status. A credit is supplied with primary material minus the expenses associated with remelting. This credit (substitution of primary material) is allocated to Module D taking consideration of a recovery rate (collection rate of 96%) and processing losses (4%).

3.9 Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data to be compared has been drawn up in accordance with DIN EN 15804 and the building context or product-specific characteristics are taken into consideration.

4. LCA: Scenarios and additional technical information

Modules A4, A5, B1-B7 and C1-C4 are not taken into consideration in this Declaration.

5. LCA: Results

SYSTEM BOUNDARIES (X = INCLUDED IN THE LCA; MND = MODULE NOT DECLARED)

Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Production	Transport	Assembly	Use / Application	Maintenance	Repairs	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Landfilling	Re-use, 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	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

LCA RESULTS – ENVIRONMENTAL IMPACT: 1kg

Parameter	Unit	A1 - A3	D
Global Warming Potential	[kg CO_2 equiv.]	9.4E+0	-7.6E+0
Ozone Depletion Potential	[kg CFC11 equiv.]	2.8E-7	-2.3E-7
Acidification Potential	[kg SO_2 equiv.]	4.9E-2	-4.3E-2
Eutrification Potential	[kg $(PO_4)^{3-}$ equiv.]	2.7E-3	-2.2E-3
Photochemical Ozone Creation Potential	[kg ethene equiv.]	2.9E-3	-2.5E-3
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	5.1E-6	-3.9E-6
Abiotic Depletion Potential Fossil Fuels	[MJ]	1.0E+2	-8.0E+1

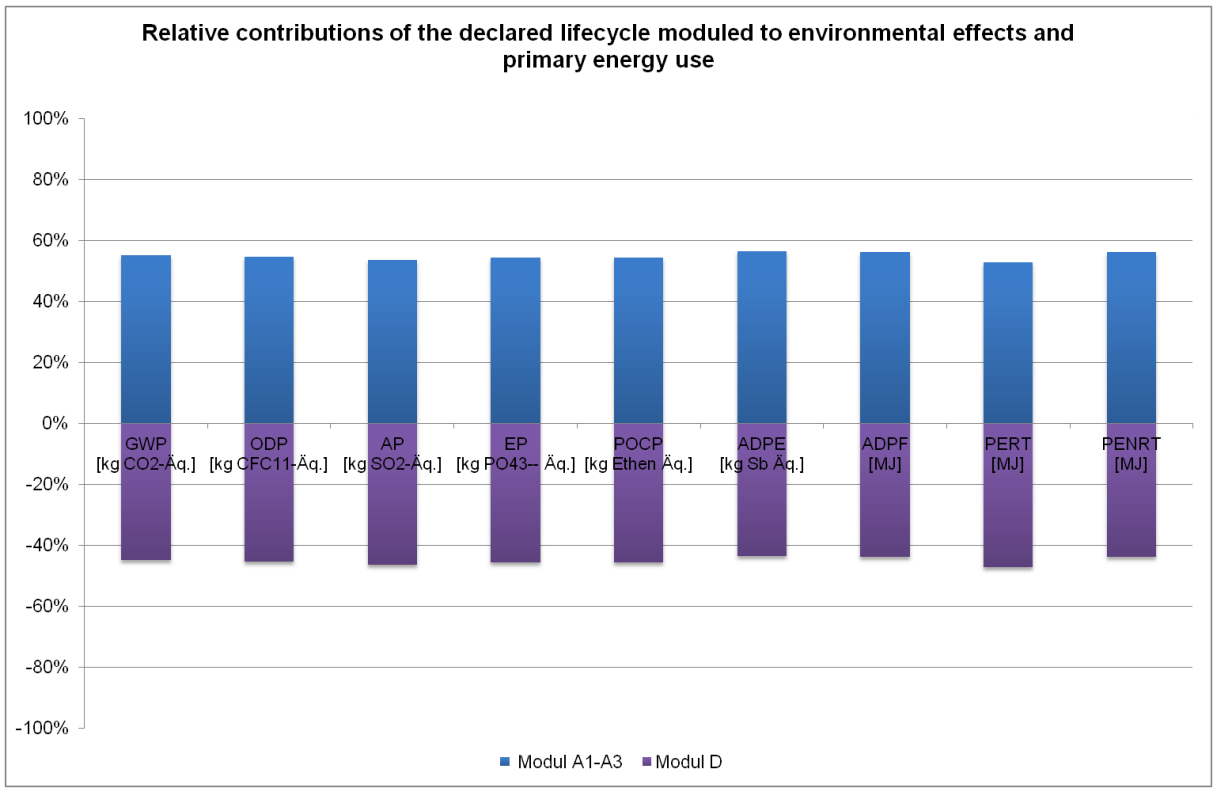
LCA RESULTS – USE OF RESOURCES: 1kg

Parameter	Unit	A1 - A3	D
Renewable primary energy as energy carrier	[MJ]	4.7E+1	-4.2E+1
Renewable primary energy as material utilisation	[MJ]	0.0E+0	0.0E+0
Total use of renewable primary energy sources	[MJ]	4.7E+1	-4.2E+1
Non-renewable primary energy as energy carrier	[MJ]	1.2E+2	-9.5E+1
Non-renewable primary energy as material utilisation	[MJ]	0.0E+0	0.0E+0
Total use of non-renewable primary energy sources	[MJ]	1.2E+2	-9.5E+1
Use of secondary materials	[kg]	0.0E+0	-
Renewable secondary fuels	[MJ]	5.0E-2	-4.9E-3
Non-renewable secondary fuels	[MJ]	5.1E-2	-4.5E-2
Net use of fresh water	[m^3]	1.3E-1	-1.1E-1

LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1kg

Parameter	Unit	A1 - A3	D
Hazardous waste for disposal	[kg]	7.9E-3	-6.4E-3
Disposed of, non-hazardous waste	[kg]	2.4E+0	-2.1E+0
Disposed of, radioactive waste	[kg]	7.9E-3	-6.4E-3
Components for re-use	[kg]	0.0E+0	0.0E+0
Materials for recycling	[kg]	0.0E+0	9.6E-1
Materials for energy recovery	[kg]	0.0E+0	0.0E+0
Exported electrical energy	[MJ]	0.0E+0	0.0E+0
Exported thermal energy	[MJ]	0.0E+0	0.0E+0

6. LCA: Interpretation



The greatest contribution to the **Global Warming Potential (GWP, 100 years)** is made by the provision of preliminary products in the form of aluminium ingots (approx. 94%). The rest (approx. 6%) is caused by actual production of aluminium sheet. Transporting the aluminium ingots accounts for 0.1% of the emissions. All in all, approx. 81% of all GWP emissions are credited by recycling the aluminium at the end of life.
The **Ozone Depletion Potential (ODP)** is dominated by the provision of the aluminium ingot preliminary product (93%). 7% is attributable to production of the aluminium sheet. A total of 82% of all ODP emissions are credited by recycling the aluminium.
Approx. 96% of the **Acidification Potential (AP)** is triggered by the provision of raw materials in the form of aluminium ingots during the production stage. The rest (approx. 4%) is caused by actual production of aluminium sheet. A credit of approx. 88% of total AP emissions is offset primarily by recycling the aluminium.
The greatest contribution to the **Eutrification Potential (EP)** is made by the provision of preliminary products in the form of aluminium ingots (approx. 94%). 6% is the result of production of aluminium sheet. In all, approx. 81% of all emissions are credited.
Approx. 95% of the **Photochemical Ozone Creation Potential (POCP)** is triggered by the provision of raw materials in the form of aluminium ingots during the production stage. The rest (approx. 5%) is caused by actual production of aluminium sheet. Credits account for approx. 86% here.
The **abiotic consumption of resources (ADP elementary)** is largely caused by the product stage (Module A1), whereby the upstream chain associated with aluminium ingot contributes approx. 98% to overall ADP elementary. 2% is attributable to the aluminium sheet production process. Total credits account for approx. 77%.
The **abiotic consumption of resources (ADP fossil)** is primarily the result of contributions made by the upstream chains in Module A1. 92% of the ADP fossil is triggered by production of aluminium ingot while 8% is attributable to production of the aluminium sheet. A credit of approx. 78% is largely attributable to aluminium recycling.
Approx. 72% of **total primary energy requirements** is covered by non-renewable energy sources and approx. 28% by renewable energies.
The **total use of renewable primary energy sources (PERT)** is largely the result of the upstream chains associated with manufacturing preliminary products (Module A1), whereby the influence of aluminium ingot production is particularly apparent at approx. 98%. 2% is incurred during aluminium sheet production. The credit (Module D) accounts for a total of approx. 90% and is attributable to aluminium recycling.
In an analysis of the **total non-renewable primary energy requirements (PENRT)**, the upstream chains associated with manufacturing preliminary products make the main contribution with approx. 92% attributable to the production of aluminium ingots. Production of polished aluminium sheet accounts for 8% of non-renewable energy requirements. Credits totalling approx. 79% are awarded which are the result of recycling the metallic preliminary products.

7. Requisite evidence

The product under review involves a semi-finished product. Evidence concerning weathering, for example, can not be provided for semi-finished products but only for the respective specifically designed and applied end products.

8. References

BGI 5081: 2012-07, Component Booklet, Industrial Safety and Health at Work, Professional association for the building industry, Berlin

DIN 1306:1984-06, Density, concepts, presentation of values

DIN 4102:1998-05, Fire behaviour of building materials and building components

DIN 18516-1:2010-06, Cladding for external walls, ventilated at rear – Part 1: Requirements, Principles of testing

DIN 18807-9:1998-06, Trapezoidal sheeting in buildings, Aluminium trapezoidal sheeting and their connections, application and construction

DIN EN 485-2:2009-1, Aluminium and aluminium alloys – Sheet, strip and plate – Part 2: Mechanical properties

DIN EN 573-3:2009-08, Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 3: Chemical composition and form of products

DIN EN 1999-1-1:2010-05, Design of aluminium structures

DIN EN 13501-1:2010-01, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

DIN EN ISO 7599:2010-12, Anodizing of aluminium and its alloys – General specifications for anodic oxidation coatings on aluminium

EN ISO 6892-1:2009-12, Metallic materials – Tensile testing – Part 1: Method of test at room temperature

EN ISO 7345:1996-01, Thermal insulation – Physical quantities and definitions

European Aluminium Association: 2013-04, Environmental Profile Report for the European Aluminium Industry, http://www.alueurope.eu/wp-content/uploads/2011/10/Environmental-Profile-Report-for-the-European-Aluminium-Industry-April-2013.pdf

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Kammer 2009: Aluminium Taschenbuch 2009, 16th print run, Dr.-Ing. C.Kammer, Aluminium-Verlag Marketing und Kommunikation GmbH, Düsseldorf

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General Principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013-04

Product Category Rules for Construction Products, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report, 2013-04

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

EN 15804:2012-04, Sustainability of construction works - Environmental product declarations – Core rules for the product category of construction products

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In my capacity as a public translator for the English language, duly registered, commissioned and sworn by the President of the Landgericht (Regional Court) Saarbrücken, I hereby certify the foregoing to be a true and complete translation of the copy which has been submitted to me.

Marius Schütz, Theley, 26 February 2014