

# 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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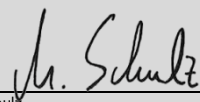
Coil-coated aluminium sheet

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

[www.bau-umwelt.com](http://www.bau-umwelt.com) / <https://epd-online.com>



## 1. General information

<p>Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association GDA)</p> <hr/> <p><b>Programme holder</b> IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany</p> <hr/> <p><b>Declaration number</b> EPD-GDA-20130259-IBG1-EN</p> <hr/> <p><b>This Declaration is based on the Product Category Rules:</b> Products of aluminium and aluminium alloys, 10-2012 (PCR tested and approved by the independent Expert Committee (SVA))</p> <hr/> <p><b>Issue date</b> 18.11.2013</p> <hr/> <p><b>Valid until</b> 17.11.2018</p> <hr/> <p></p> <hr/> <p>Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)</p> <hr/> <p></p> <hr/> <p>Dr.-Ing. Burkhart Lehmann (Managing Director IBU)</p>	<p>Coil-coated aluminium sheet</p> <hr/> <p><b>Owner of the Declaration</b> Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association GDA) Am Bonnhof 5 40474 Düsseldorf Germany</p> <hr/> <p><b>Declared product/unit</b> 1 kg coil-coated aluminium sheet</p> <hr/> <p><b>Area of applicability:</b> This document refers to the manufacture of 1 kg coil-coated sheet aluminium. This sample EPD is based on a specific product which was drawn up weighted by the production volumes of three companies. On account of the comparable production technologies used by the individual companies, good data representativity can be assumed. The data collated concerns the period 2011. Liability by IBU concerning manufacturer's information, LCA data and evidence is excluded.</p> <hr/> <p><b>Verification</b></p> <p>The EN 15804 CEN standard serves as the core PCR. Verification of the EPD by an independent third party in accordance with ISO 14025</p> <p><input type="checkbox"/> internally      <input checked="" type="checkbox"/> externally</p> <hr/> <p></p> <hr/> <p>Matthias Schulz (Independent verifier appointed by the SVA)</p>
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## 2. Product

### 2.1 Product description

Coil-coated 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. Technical metal production is followed by organic coating. The product dimensions as well as type, thickness and optical design of the surface refinement are customised. The specific product was calculated according to the production volumes of three manufacturing members of the German Aluminium Association.

### 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 <sup>3</sup>
Melting point as per Kammer 2009	660	°C

Electrical conductivity at 20 °C as per Kammer 2009	37.7	m/Ωmm <sup>2</sup>
Thermal conductivity to EN ISO 7345	235	W/(mK)
Linear thermal expansion rate to EN ISO 6892-1	23.1	10 <sup>-6</sup> K <sup>-1</sup>
Elasticity module to EN ISO 6892-1	70000	N/mm <sup>2</sup>
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 <sup>2</sup>
Tensile strength Rm min. to EN ISO 6892-1	100 - 350	N/mm <sup>2</sup>
Elongation at break A5 min. to EN ISO 6892-1	6 - >30	%

### 2.4 Placing on the market / Application rules

- DIN 18516-1
- DIN 18807-9
- DIN EN 485-2
- EN 507
- EN 508-2
- DIN EN 573-3
- DIN EN 1396
- DIN EN 1999-1-1

- DIN 4102
- DIN EN 13501-1
- DIN EN 14783
- EN 13964/+A1

## 2.5 Delivery status

The material is supplied semi-finished in customised dimensions and with customised surface coating 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. The coating involves application of coating materials to the sheets with a mass percentage of approx. 3%.

## 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. Technical metal reforming is followed by coating the sheets once or more in a continuous process. There is practically no limit to the variety of colours available for organic top layers.

## 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 and coating processes for aluminium sheet contribute 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. The coating process requires the use of organic and inorganic solvents. Solvent vapours are thermally utilised by means of combustion at the plant location. 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 measures are required when processing and handling 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 the coil-coated 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. Coil-coated aluminium sheet 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 fully recyclable. After use, 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](http://www.aluinfo.de).

### 3. LCA: Calculation rules

#### 3.1 Declared unit

The declared unit involves 1 kg coil-coated 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

Thermal energy from natural gas was used for estimating the thermal energy from incinerating solvents. The calorific value of the solvents was taken into consideration in this process. NMVOC emissions for incineration (1% of the input) were also assumed. The data set from the EPD Blank Aluminium Sheet with the Declaration number EPD-GDA-20130258-IBG1-DE was applied.

#### 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 coil-coated 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 Germany and France as a reference area. This means that apart from the production processes, the pre-stages also of relevance for Germany and France such as provision of electricity or energy sources were used. The power mix for Germany and France for reference year 2009 is applied.

#### 3.6 Data quality

The data collated by the GDA association members for the production year 2011 was used for modelling the product stage of coil-coated aluminium sheet. 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 2011. 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 ("closed loop"). 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.

Credits are incurred as a result of 100% recyclability of aluminium and are indicated in Module D. After waste collection (a 96% collection rate was assumed), the aluminium scrap is melted (remelting losses of approx. 7%) and can be re-used as recycled material. The value of the credit after remelting was calculated on the basis of the data set for primary production.



## 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	MND	X

### LCA RESULTS – ENVIRONMENTAL IMPACT: 1kg

Parameter	Unit	A1 - A3	D
Global Warming Potential	[kg CO <sub>2</sub> equiv.]	1.1E+1	-7.8E+0
Ozone Depletion Potential	[kg CFC11 equiv.]	3.0E-7	-2.4E-7
Acidification Potential	[kg SO <sub>2</sub> equiv.]	5.4E-2	-4.4E-2
Eutrophication Potential	[kg (PO <sub>4</sub> ) <sup>3-</sup> equiv.]	3.0E-3	-2.3E-3
Photochemical Ozone Creation Potential	[kg ethene equiv.]	3.3E-3	-2.5E-3
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	5.6E-6	-4.0E-6
Abiotic Depletion Potential Fossil Fuels	[MJ]	1.2E+2	-8.2E+1

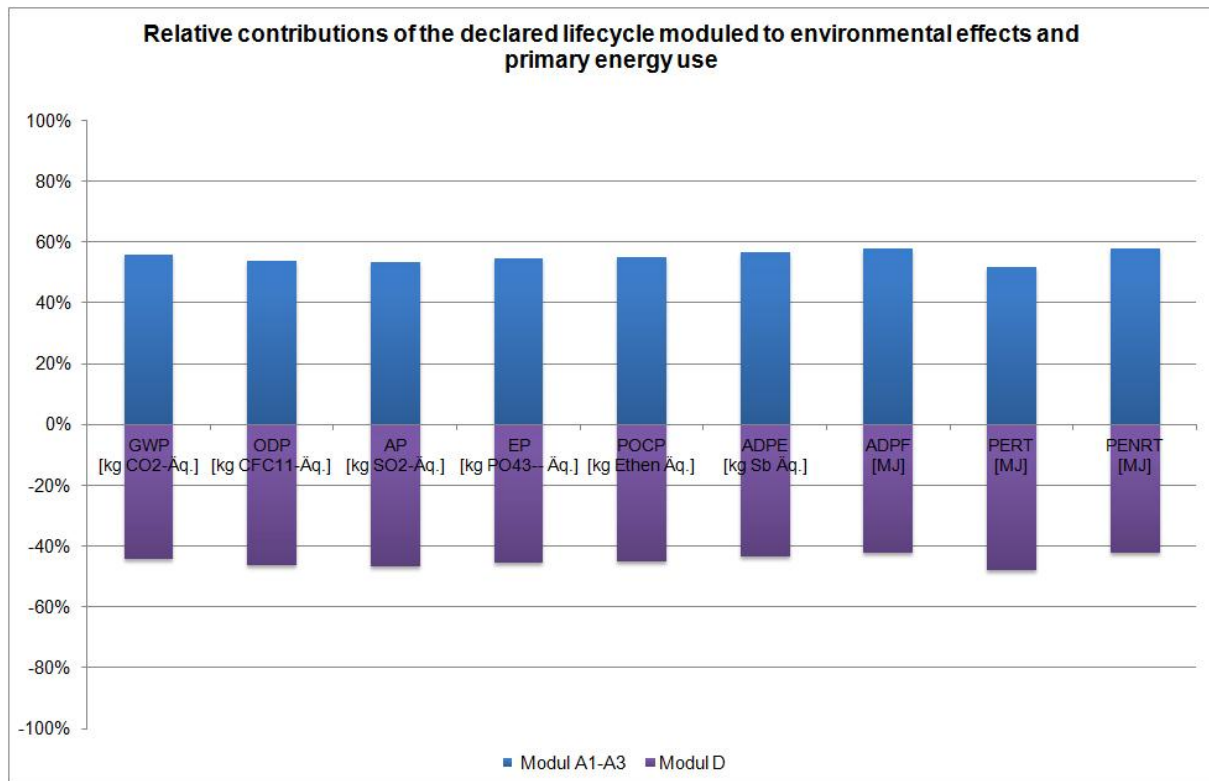
### LCA RESULTS – USE OF RESOURCES: 1kg

Parameter	Unit	A1 - A3	D
Renewable primary energy as energy carrier	[MJ]	5.0E+1	-4.6E+1
Renewable primary energy as material utilisation	[MJ]	0.0E+0	0.0E+0
Total use of renewable primary energy sources	[MJ]	5.0E+1	-4.6E+1
Non-renewable primary energy as energy carrier	[MJ]	1.4E+2	-1.1E+2
Non-renewable primary energy as material utilisation	[MJ]	0.0E+0	0.0E+0
Total use of non-renewable primary energy sources	[MJ]	1.4E+2	-1.1E+2
Use of secondary materials	[kg]	0.0E+0	-
Renewable secondary fuels	[MJ]	5.5E-2	-5.4E-3
Non-renewable secondary fuels	[MJ]	5.7E-2	-5.0E-2
Net use of fresh water	[m <sup>3</sup> ]	1.4E-1	-1.3E-1

### LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1kg

Parameter	Unit	A1 - A3	D
Hazardous waste for disposal	[kg]	9.9E-3	-7.0E-3
Disposed of, non-hazardous waste	[kg]	2.6E+0	-2.3E+0
Disposed of, radioactive waste	[kg]	9.0E-3	-7.0E-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 supply of preliminary products (approx. 89%) – largely through aluminium ingots and the manufacture of aluminium sheet (approx. 5%). The rest (approx. 11%) is caused by the provision of auxiliaries and the actual coil coating. Varnish accounts for 2% of the emissions. Another approx. 3% is caused by the use of thermal energy while approx. 1% is incurred by electrical energy. All in all, approx. 79% 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 preliminary products (aluminium sheet 98%). A total of 85% of all ODP emissions are credited by recycling the aluminium.

Approx. 98% of the **Acidification Potential (AP)** is triggered by the provision of raw materials for aluminium sheet during the production stage. A credit of approx. 89% of total AP emissions is offset primarily by recycling the aluminium.

The greatest contribution to the **Eutrophication Potential (EP)** is made by the provision of preliminary products in the form of aluminium ingots (approx. 90%). 6% is the result of production of aluminium sheet. During actual coil coating, varnish accounts for approx. 2% of emissions. Another approx. 1% is caused by the use of thermal and electrical energy. In all, approx. 79% of all emissions are credited.

The **Photochemical Ozone Creation Potential (POCP)** is triggered by the provision of preliminary products, i.e. aluminium sheet production (approx. 93%) and varnish for coating the aluminium sheet (approx. 5%). Credits account for approx. 81% here.

The **abiotic consumption of resources (ADP elementary)** is largely caused by the product stage (Modules A1-A3) where primarily the upstream chains

from A1 (aluminium ingots approx. 86% and pre-treatment of sheets with chrome approx. 7%) contribute to overall ADP elementary. Total credits account for approx. 73%.

The **abiotic consumption of resources (ADP fossil)** is primarily the result of contributions made by the upstream chains in Module A1. Aluminium sheet production (88%), the use of varnish (approx. 5%) for coating the sheets and thermal energy (approx. 5%) contribute to overall ADPF. A credit of approx. 68% is largely attributable to aluminium recycling. Approx. 74% of **total primary energy requirements** is covered by non-renewable energy sources and approx. 26% 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 sheet production is particularly apparent at approx. 99% and approx. 1% attributable to the use of electric energy during the coil-coating process. The credit (Module D) accounts for a total of approx. 90% which is attributable to aluminium recycling.

In an analysis of the **total use of non-renewable primary energy sources (PENRT)**, the upstream chains associated with manufacture of the preliminary products make the main contribution: approx. 89% is attributable to the provision of blank aluminium sheet, approx. 5% is incurred by coating with varnish and approx. 4% by using thermal energy during the coil-coating process. All in all, approx. 70% is credited, primarily attributable to recycling the aluminium.

## 7. Requisite evidence

The product under review involves a semi-finished product. Evidence concerning weathering, for example, cannot 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 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 4102:**1998-05, Fire performance of building materials and components

**DIN EN 485-2:**2009-01, 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 1396:**2007-04, Aluminium and aluminium alloys – Coil-coated sheet and strip for general applications – Specifications

**DIN EN 14783:**2013-07, Fully-supported metal sheet and strip for roofing, external cladding and internal lining – Product specification and requirements

**EN 507:**2000-01, Roofing products from metal sheet - Specification for fully-supported roofing products of aluminium sheet

**EN 508-2:**2009-07, Roofing products from metal sheet– Specification for self-supporting products of steel, aluminium or stainless steel sheet – Part 2: Aluminium

**EN 13964:**2004+A1:2006:2007-02, Suspended ceilings – Requirements and test methods

**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

**GaBi 6 2013:** PE INTERNATIONAL AG; GaBi 6: Software system and data base for comprehensive analysis. Copyright TM. Stuttgart, Echterdingen, 1992-2013

**GaBi 6 2013D:** GaBi 6: GaBi 6 documentation: data sets in the data base for comprehensive analysis. Copyright TM. Stuttgart, Echterdingen, 1992-2013. <http://documentation.gabi-software.com/>

**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>

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

**Directive 96/603/EC:**1996-10, Specification of a directory of products to be classified as category A "No contribution to fire" in accordance with the Council decision 94/611/EC on construction products for implementing Article 20 of Directive 89/106/EEC

**Institut Bauen und Umwelt e.V.,** Berlin (pub.):

**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