Environmental Product Declaration
Guangdong Gaoli Aluminum Industry Co., Ltd.

Solid Aluminum Panels
Name of the Manufacturer: Guangdong Gaoli Aluminium Industry Co., LTD

Program Operator: ASTM International

Declaration Number: EPD 118


Date of Issuance: September 27, 2019

End of Validity: September 27, 2024

Product Name: Solid aluminum panels

Product Group: Products of aluminium and aluminium alloys

Declared Product/Declared Unit: 1 ton solid aluminum panels

EPD Scope: Cradle-to-gate A1, A2, and A3

Verification:

The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration according to ISO 14025 and ISO 21930.

☐ internal  ☑ external

LCA Reviewer and EPD Verifier:

Name: Timothy S. Brooke
Organization: ASTM International

Signature: [Signature]

1. General Information
Environmental Product Declaration:
Guangdong Gaoli Aluminum Industry Co. Ltd.
Solid Aluminum Panels
According to EN 15804, ISO 14025 and ISO 21930

Product

2.1 Product Description
The declared unit is 1 metric ton solid aluminum panels – as Manufactured at Guangdong Gaoli Aluminum Industry Co. Ltd.’s Chinese facility. To convert from one metric tonne to one kilogram, a factor of 0.001 is applied. Product specifications for the solid aluminum panel product line is available at: https://globond.com/products

The product group is representative of the entire range of solid aluminum panels produced at the facility.

The products are manufactured in accordance with the following standards:

- ASTM B221-13/B221M-13 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- ASTM B241/B241M-12e1 Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
- ASTM B429/B429M-10e1 Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
- ASTM B491/B491M-06 Standard Specification for Aluminum and Aluminum-Alloy Extruded Round Tubes for General-Purpose Applications

2.2 Application:
Solid aluminum panels are used in a variety of construction applications. Various grades, thicknesses, and dimensions are specified according to requirements specific to the application.
2.3 Technical Data:

Table 1: Technical Information

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>2.66-2.84</td>
<td>(kg/m³) x 10³</td>
</tr>
<tr>
<td>Melting point (typical)</td>
<td>475-655</td>
<td>°C</td>
</tr>
<tr>
<td>Electrical conductivity (Typical) at 20°C/68°F</td>
<td>Equal Volume:16-36</td>
<td>MS/m (0.58% IACS)</td>
</tr>
<tr>
<td>Thermal conductivity (Typical) at 25°C/77°F</td>
<td>113-234</td>
<td>W/(m.K)</td>
</tr>
<tr>
<td>Average Coefficient of thermal expansion (Typical)</td>
<td>22.3-23.9</td>
<td>per °C</td>
</tr>
<tr>
<td>20° to 100°C/68° to 212°F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modulus of elasticity (Typical)</td>
<td>69-73</td>
<td>MPa x 10³</td>
</tr>
<tr>
<td>Hardness (Typical)</td>
<td>19-150</td>
<td>HB</td>
</tr>
<tr>
<td>Yield strength (min)</td>
<td>15-490</td>
<td>MPa</td>
</tr>
<tr>
<td>Ultimate tensile strength (min)</td>
<td>60-560</td>
<td>MPa</td>
</tr>
<tr>
<td>Breaking elongation (min) (50mm &amp; 4D)</td>
<td>&gt;4</td>
<td>%</td>
</tr>
</tbody>
</table>

Strength and other technical properties vary and are available from the manufacturer for specific orders.

2.4 Delivery Status:
The declared unit is 1 ton solid aluminum panels. The product is available in different dimensions and thicknesses.

2.5 Base Materials:
The solid aluminum panel product is 100% aluminium. Aluminium is an alloy that also contains small amounts of other base metals. For the purposes of toxicity screening, aluminium is considered a base ingredient with CAS # 7429-90-5.

2.6 Manufacturing:
The processes that occur at Guangdong Gaoli Aluminum Industry Co. Ltd.’s facility include: receipt of aluminum billet, extrusion, and the packaging of the finished aluminium product.

2.7 Environment and Health Considerations during Manufacturing:
Air: Hazardous air emission releases comply with regulatory thresholds.

Water/soil: Pollutants in wastewater discharge comply with regulatory thresholds.

Noise: Due to adequate acoustical absorption and mitigation devices, measurements of sound levels have shown that all values inside and outside the production plant comply with regulatory thresholds.

2.8 Product Processing/Installation:
The product is installed in a manner and with equipment that is specific to the application for which it was purchased.
2.9 Packaging:
Solid aluminum panels are packaged in low density polyethylene plastic wrap. The product is secured to pallets using steel straps. Any other packaging that is required by a particular customer is negotiated separately from the materials contract and is thus outside the system boundary. No other packaging was included in the product system.

2.10 Conditions of Use:
No special features of contents are required for the period of use.

2.11 Environment and Health Considerations During Use:
Solid aluminum panels are comprised of inert materials and poses no significant environmental or health considerations during the use phase.

2.12 Reference Service Life:
No reference service life is declared in this EPD as the scope is limited to A1-A3.

2.13 Extraordinary Effects:
Fire: Aluminum products comply with all local and federal laws with respect to fire hazards and control.

Water: There is no evidence to suggest water runoff or exposure under normal and intended operation will violate general water quality standards.

Mechanical destruction: Not relevant for aluminum extrusions.

2.14 Re-use Phase:
At the end of the product's service life, aluminium may be reused or recycled, however, neither of these are included in this EPD. No energy recovery possibilities exist.

2.15 Disposal:
The waste code in accordance with the European Waste Index is 17 04 02. At the end of service life the product may either be re-used, disposed in a landfill, or recycled.

2.16 Further Information:
No further information is reported in this EPD.

2.17 Content Declaration Regarding Potential Toxicity
This EPD makes no claim as to the potential toxicity of the product during use. As noted in Section 2.5, the product is 100% aluminium which is considered a base ingredient with CAS # 7429-90-5. No known health risks are associated the use of aluminum panels.
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3: LCA Calculation Rules

3.1 Declared Unit:
The declared unit is 1 ton solid aluminum panels produced by Guangdong Gaoli Aluminium Industry Co. Ltd.

3.2 System Boundary:
The system boundary for this study is limited to a cradle-to-gate focus. The following three life cycle stages as per the governing PCR are included in the study scope:

- A1- Raw material supply (upstream processes): bauxite extraction, handling, and smelting to produce aluminium billets.
- A2- Transportation: transportation of all input materials and fuels from the suppliers to the gate of the manufacturing facility.
- A3- Manufacturing (core process): the processes that occur at Guangdong Gaoli Aluminum Industry Co. Ltd.’s facility: material handling, extrusion, and packaging. Also includes the operations of the manufacturing facility and all process emissions that occur at the production facility.

3.3 Estimates and Assumptions:
All significant foreground data was gathered from the manufacturer based on measured values (i.e. without estimation). The weighted average product profile is assumed to be representative of the various dimensions and options offered by Guangdong Gaoli Aluminum Industry Co. Ltd.

3.4 Cut-off Criteria:
The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO14044:2006, section 6 of the IBU PCR Part A:

- All inputs and outputs to a (unit) process were included in the calculation for which data is available. Data gaps were filled by conservative assumptions with average or generic data. Any assumptions for such choices were documented;
- In case of insufficient input data or data gaps for a unit process, the cut-off criteria were 1% of renewable and non-renewable primary energy usage and 1% of the total mass of that unit process. The total neglected input flows, e.g. per module A1-A3 were a maximum of 5% of energy usage and mass. Conservative assumptions in combination with plausibility considerations and expert judgement were used to demonstrate compliance with these criteria;
- Particular care was taken to include material and energy flows known to have the potential to cause significant emissions into air and water or soil related to the environmental indicators of this standard. Conservative assumptions in combination with plausibility considerations and expert judgement were be used to demonstrate compliance with these criteria.
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3.5 Background Data and 3.6 Data Quality:
Data was gathered for the primary material inputs used in the production of the solid aluminium panels for calendar year 2018. Table 2 describe each LCI data source for raw materials (A1), transportation by mode (A2) and the core manufacture process (A3). Table 2 also includes a data quality assessment for all secondary data on the basis of the technological, temporal, and geographical representativeness as per the IBU PCR.

Table 2: Secondary Data Sources and Data Quality Assessment

<table>
<thead>
<tr>
<th>A1: Raw Material Inputs</th>
<th>LCI Data Source</th>
<th>Geography</th>
<th>Year</th>
<th>Data Quality Assessment</th>
</tr>
</thead>
</table>
| Aluminium Billet        | Ecoinvent 3.3: GM Aluminium, primary, ingot (IAI Area, EU27 & EFTA) | Middle East | 2018 | Technology: very good  
Process models average global technology  
Time: very good  
Data is <5 years old  
Geography: very good  
Data is representative of global conditions. |

<table>
<thead>
<tr>
<th>A2: Transportation</th>
<th>LCI Data Source</th>
<th>Geography</th>
<th>Year</th>
<th>Data Quality Assessment</th>
</tr>
</thead>
</table>
| Trucking          | ecoinvent 3.3: Transport, freight, lorry >32 metric ton, EURO3 (GLO) | Global    | 2018 | Technology: very good  
Process models average global technology  
Time: good  
Data is 6 years old  
Geography: very good  
Data is representative of global conditions. |

<table>
<thead>
<tr>
<th>A3: Manufacturing</th>
<th>LCI Data Source</th>
<th>Geography</th>
<th>Year</th>
<th>Data Quality Assessment</th>
</tr>
</thead>
</table>
| Electricity      | ecoinvent 3.3: Electricity, high voltage (OM) | China     | 2018 | Technology: very good  
Process models average China technology  
Time: very good  
Data is <5 years old  
Geography: very good  
Data is representative of China electricity. |
| Natural Gas      | ecoinvent 3.3: Heat, central or small-scale, natural gas (RoW) | Global    | 2018 | Technology: very good  
Process models average global technology  
Time: very good  
Data is <5 years old  
Geography: very good  
Data is representative of global conditions. |
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<table>
<thead>
<tr>
<th>Ancillary Materials and Packaging</th>
<th>LCI Data Source</th>
<th>Geography</th>
<th>Year</th>
<th>Data Quality Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>ecoinvent 3.3: Heat, district or industrial, other than natural gas (RoW)</td>
<td>Global</td>
<td>2018</td>
<td>Technology: very good Process models average global technology Time: very good Data is &lt;5 years old Geography: very good Data is representative of global conditions.</td>
</tr>
<tr>
<td>Pallets</td>
<td>ecoinvent 3.3: EUR-flat pallet (GLO)</td>
<td>market for</td>
<td>Alloc Rec, U</td>
<td>Global</td>
</tr>
<tr>
<td>Steel Straps</td>
<td>World Steel data for finished cold rolled coil</td>
<td>Global</td>
<td>2012</td>
<td>Technology: very good Process models average global technology Time: very good Data is 7 years old Geography: very good Data is representative of global conditions.</td>
</tr>
<tr>
<td>Plastic Wrap</td>
<td>ecoinvent 3.3: Packaging film, low density polyethylene (GLO)</td>
<td>market for</td>
<td>Alloc Def, U Packaging</td>
<td>Global</td>
</tr>
<tr>
<td>Lubricants</td>
<td>ecoinvent 3.3: Lubricating oil (GLO)</td>
<td>market for</td>
<td>Alloc Rec</td>
<td>Global</td>
</tr>
<tr>
<td>Water</td>
<td>LCI Data Source</td>
<td>Geography</td>
<td>Year</td>
<td>Data Quality Assessment</td>
</tr>
<tr>
<td>Municipal Water</td>
<td>Modeled as elementary flow</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Waste</td>
<td>LCI Data Source</td>
<td>Geography</td>
<td>Year</td>
<td>Data Quality Assessment</td>
</tr>
<tr>
<td>Aluminium recycled</td>
<td>Internally recycled</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
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3.7 Period under Review:
Data was gathered for the primary material inputs used in the production of the solid aluminum panels for calendar year 2018.

3.8 Allocation:
Guangdong Gaoli Aluminum Industry Co. Ltd. produces valuable aluminium scrap and no other valuable coproducts from their extrusion operations. The IBU PCR requires economic allocation but, in this case, the overall value of the various coproducts was less than 5% of total revenue. Thus, in accordance with the PCR’s principle of making conservative estimations, we did not allocate any of the environmental burden to the coproducts and instead allocated 100% to the primary product output.

Recycling processes were treated as closed loop recycling because the scrap is recycled in the same facility. No credits were given to the product system for the value of the recyclable materials and the burden to recycle the scrap was incorporated within the modeled unit processes.

3.9 Comparability:
This LCA was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used.
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4: LCA: Scenarios and additional technical information

The scope of this EPD is limited to modules A1-A3 and thus no additional scenario or technical information is applicable.

5. LCA: Results

Life cycle impact assessment (LCIA) is the phase in which the set of results of the inventory analysis – the inventory flow table – is further processed and interpreted in terms of environmental impacts and resource use inventory metrics. As specified in the IBU PCR, Table 3 below summarises the LCA results for the cradle-to-gate (A1-A3) product system.

Table 3: LCA Results
Description of the System Boundary
(x: included in LCA; mnd: module not declared)

<table>
<thead>
<tr>
<th>Product</th>
<th>Construction</th>
<th>Installation</th>
<th>Use</th>
<th>End-of-life</th>
<th>Benefits of Loads Beyond the System Boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Material supply</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5 B1 B2 B3 B4 B5 B6 B7 C1 C2 C3 C4 D D D</td>
</tr>
<tr>
<td>Transport</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>mnd</td>
<td>mnd mnd mnd mnd mnd mnd mnd mnd mnd mnd mnd mnd mnd</td>
</tr>
</tbody>
</table>
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### Table 3 Continued: Impact Assessment Results for 1 ton solid aluminum panels

<table>
<thead>
<tr>
<th>LCIA Indicators</th>
<th>Unit</th>
<th>A1-A3 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GWP</strong> Global Warming Potential (climate change)</td>
<td>kg CO2-eq</td>
<td>3.20E+04</td>
</tr>
<tr>
<td><strong>ODP</strong> Ozone Depletion Potential</td>
<td>kg CFC-11-eq</td>
<td>5.84E-04</td>
</tr>
<tr>
<td><strong>AP</strong> Acidification Potential</td>
<td>kg SO2-eq</td>
<td>1.84E+02</td>
</tr>
<tr>
<td><strong>EP</strong> Eutrophication Potential</td>
<td>kg PO4-eq</td>
<td>2.65E+01</td>
</tr>
<tr>
<td><strong>POCP</strong> Photochemical Ozone Creation/Smog Potential</td>
<td>kg C2H4 eq</td>
<td>1.03E+01</td>
</tr>
<tr>
<td><strong>ADPE</strong> Abiotic Depletion Potential for Non-Fossil Resources</td>
<td>kg Sb eq</td>
<td>1.15E-02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inventory Metrics – Resources</th>
<th>Unit</th>
<th>A1-A3 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PERE</strong> Use of renewable primary energy as energy</td>
<td>MJ</td>
<td>1.23E+04</td>
</tr>
<tr>
<td><strong>PERM</strong> Use of renewable primary energy as a material</td>
<td>MJ</td>
<td>0.00E+00</td>
</tr>
<tr>
<td><strong>PERT</strong> Total use of renewable primary energy</td>
<td>MJ</td>
<td>1.23E+04</td>
</tr>
<tr>
<td><strong>PENRE</strong> Use of non-renewable primary energy as energy</td>
<td>MJ</td>
<td>2.70E+05</td>
</tr>
<tr>
<td><strong>PENRM</strong> Use of non-renewable primary energy as a material</td>
<td>MJ</td>
<td>0.00E+00</td>
</tr>
<tr>
<td><strong>PENRT</strong> Total use of non-renewable primary energy</td>
<td>MJ</td>
<td>2.70E+05</td>
</tr>
<tr>
<td><strong>SM</strong> Use of secondary materials</td>
<td>kg</td>
<td>1.39E+04</td>
</tr>
<tr>
<td><strong>RSF</strong> Use of renewable secondary fuels</td>
<td>MJ</td>
<td>4.35E+02</td>
</tr>
<tr>
<td><strong>NRSF</strong> Use of non-renewable secondary fuels</td>
<td>MJ</td>
<td>6.32E-02</td>
</tr>
<tr>
<td><strong>FW</strong> Use of freshwater resources</td>
<td>m3</td>
<td>1.80E+02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inventory Metrics – Waste and Outputs</th>
<th>Unit</th>
<th>A1-A3 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HWD</strong> Disposed of Hazardous Waste</td>
<td>kg</td>
<td>0.00E+00</td>
</tr>
<tr>
<td><strong>NHWD</strong> Disposed of Non-Hazardous Waste</td>
<td>kg</td>
<td>0.00E+00</td>
</tr>
<tr>
<td><strong>RWD</strong> Disposed of Radioactive Waste</td>
<td>kg</td>
<td>0.00E+00</td>
</tr>
<tr>
<td><strong>CRU</strong> Components for Reuse</td>
<td>kg</td>
<td>0.00E+00</td>
</tr>
<tr>
<td><strong>MFR</strong> Materials for Recycling</td>
<td>kg</td>
<td>0.00E+00</td>
</tr>
<tr>
<td><strong>MER</strong> Materials for Energy Recovery</td>
<td>kg</td>
<td>0.00E+00</td>
</tr>
<tr>
<td><strong>EEE</strong> Exported Electrical Energy (Waste to Energy)</td>
<td>kg</td>
<td>0.00E+00</td>
</tr>
<tr>
<td><strong>ETE</strong> Exported Thermal Energy (Waste to Energy)</td>
<td>kg</td>
<td>0.00E+00</td>
</tr>
</tbody>
</table>
6. Interpretation

Figure 1 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. All impact categories are dominated by Module A1. This is due to the fact this module incorporates all the upstream extraction and refining of primary aluminum which is known to be an energy-intensive process. Module A2 (transporting the aluminum to the production facility) and Module A3 (the extrusion of the aluminum) cause less than 10% of any potential impacts.

**Figure 1: Contribution of Modules A1, A2, and A3 to Environmental Impact Indicators**

- Abiotic Depletion Potential for Fossil Resources
- Abiotic Depletion Potential for Non-Fossil Resources
- Photochemical Ozone Creation/Smog Potential
- Eutrophication Potential
- Acidification Potential
- Ozone Depletion Potential
- Global Warming Potential (climate change)

Legend:
- A1: Raw Materials
- A2: Transportation
- A3: Manufacturing
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7. Requisite Evidence
No environmental claims beyond the LCA results are made in this EPD and thus no additional evidence is required.

8. References
2. EN 15804:2012 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.
6. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.