

Environmental Product Declaration  
NATIONAL ALUMINIUM PRODUCTS  
COMPANY (NAPCO) SAOG

# Extruded Aluminum



# 1. General Information

**Name of the Manufacturer:** National Aluminium Products Company SAOG

**Program Operator:** ASTM International

**Declaration Number:** EPD 119

**Reference PCR:** IBU PCR Part A: Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project report – Version 1.3 (19.06.2014). & IBU PCR Part B: Requirements on the EPD for Products of aluminium and aluminium alloys – Version 1 (07.2014).

**Date of Issuance:** September 27, 2019

**End of Validity:** September 27, 2024

**Product Name:** Extruded Aluminium

**Product Group:** Products of aluminium and aluminium alloys

**Declared Product/Declared Unit:** 1 ton extruded aluminium

**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:



## NAPCO SAOG

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According to EN 15804, ISO 14025 and ISO 21930

## 2. Product

### 2.1 Product Description

The declared unit is 1 metric ton extruded aluminium – as Manufactured at NAPCO's Oman facility. To convert from one metric tonne to one kilogram, a factor of 0.001 is applied. Product specifications for the extruded aluminium product line is available at:

[http://napcooman.com/single\\_page/download](http://napcooman.com/single_page/download)

The product group is representative of the entire range of extruded aluminium products produced at the facility.

The products are manufactured in accordance with the following standards:

- ASTM B221-13 / B221M-13 Standard specification for Aluminium and Aluminium-Alloy Extruded Bars, Rods, Wires, profiles, and Tubes
- BS EN 12020-2 Aluminium and Aluminium Alloy – Extruded Precision profiles in alloys EN AW-6060 and EN AW-6063; Tolerance on dimensions and form
- BS EN 755-3 Aluminium and Aluminium Alloy – Extruded Rod / bar, tube and profiles; Round bar, tolerances on dimensions and form
- BS EN 755-4 Aluminium and Aluminium Alloy – Extruded Rod / bar, tube and profiles; Square bar, tolerances on dimensions and form
- BS EN 755-5 Aluminium and Aluminium Alloy – Extruded Rod / bar, tube and profiles; Rectangular bar, tolerances on dimensions and form
- BS EN 755-6 Aluminium and Aluminium Alloy – Extruded Rod / bar, tube and profiles; Hexagonal bar, tolerances on dimensions and form
- BS EN 755-9 Aluminium and Aluminium Alloy – Extruded Rod / bar, tube and profiles; Profiles, tolerances on dimensions and form
- BS EN 755-2 Aluminium and Aluminium Alloy – Extruded Rod / bar, tube and profiles; Mechanical properties
- BS EN 573-3 Aluminium and Aluminium Alloy – Chemical composition and form of wrought products; Chemical composition and form of products
- BS EN 515 Aluminium and Aluminium Alloy – Wrought products – Temper designations
- BS EN 12020-1 Aluminium and Aluminium Alloy – Extruded Precision profiles in alloys EN AW-6060 and EN AW-6063; Technical condition for inspection and delivery

### 2.2 Application:

Extruded aluminium is used in a variety of applications (architectural, scaffolding, construction, industrial, automotive, electrical, electronics, etc). Various grades, thicknesses, and dimensions are specified according to requirements specific to the application.



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### 2.3 Technical Data:

Table 1: Technical Information		
Name	Value	Unit
Density	2.66-2.84	(kg/m <sup>3</sup> ) x 10 <sup>3</sup>
Melting point (typical)	475-655	°C
Electrical conductivity (Typical) at 20°C/at 68°F	Equal Volume:16-36	MS/m (0.58*%IACS)
Thermal conductivity (Typical) at 25°C/at 77°F	113-234	W/(m.K)
Average Coefficient of thermal expansion (Typical) 20° to 100°c /68° to 212°F	22.3-23.9	per °C
Modulus of elasticity (Typical)	69-73	MPa x 10 <sup>3</sup>
Hardness (Typical)	19-150	HB
Yield strength (min)	15-490	MPa
Ultimate tensile strength (min)	60-560	MPa
Breaking elongation (min) (50mm & 4D)	>4	%
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 extruded aluminium. The product is available in different dimensions and thicknesses.

### 2.5 Base Materials:

The extruded aluminium 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 process that occurs at NAPCO's Facility includes: Receipt of aluminium billets, extrusion, anodizing, powder coating, crimping, fabrication, packing and dispatch of finished extruded aluminium products.

### 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.



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#### 2.9 Packaging:

Extruded aluminium is 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:

Extruded aluminium is 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, extruded aluminiums 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 extruded aluminium.



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## 3: LCA Calculation Rules

### 3.1 Declared Unit:

The declared unit is 1 ton extruded aluminium produced by National Aluminium Products Company (NAPCO) SAOG

### 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 NAPCO'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 NAPCO.

### 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 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 extruded aluminium 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				
A1: Raw Material Inputs				
Inputs	LCI Data Source	Geography	Year	Data Quality Assessment
Aluminium Billet	ecoinvent 3.3: GM Aluminium, primary, ingot {IAI Area, EU27 & EFTA}  aluminium, ingot, primary, import from Middle East (Gulf cooperation Council)   Cut-off, U	Middle East	2018	<b>Technology:</b> very good Process models average global technology <b>Time:</b> very good Data is <5 years old <b>Geography:</b> very good Data is representative of global conditions.
PVDF Powder Coating	ecoinvent 3.3: Polyvinylfluoride {GLO}  market for   Cut-off, U	Global	2018	<b>Technology:</b> very good Process models average global technology <b>Time:</b> good Data is less < 5 years old <b>Geography:</b> very good Data is representative of global conditions.
Sulfuric Acid Anodizing Solution	ecoinvent 3.3: Sulfuric acid {GLO}  market for   Cut-off, U	Global	2018	<b>Technology:</b> very good Process models average global technology <b>Time:</b> good Data is less < 5 years old <b>Geography:</b> very good Data is representative of global conditions.
A2: Transportation				
Inputs	LCI Data Source	Geography	Year	Data Quality Assessment
Trucking	ecoinvent 3.3: Transport, freight, lorry >32 metric ton, EURO3 {GLO}  market for   Cut-off, U	Global	2018	<b>Technology:</b> very good Process models average global technology <b>Time:</b> good Data is 6 years old <b>Geography:</b> very good Data is representative of global conditions.





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A3: Manufacturing				
Energy	LCI Data Source	Geography	Year	Data Quality Assessment
Electricity	ecoinvent 3.3: Electricity, high voltage {OM}  market for electricity, high voltage   Cut-off, U	Oman	2018	<b>Technology:</b> very good Process models average Omani technology <b>Time:</b> very good Data is < 5 years old <b>Geography:</b> very good Data is representative of Oman electricity.
Natural Gas	ecoinvent 3.3: Heat, central or small-scale, natural gas {RoW}  heat production, natural gas, at boiler atmospheric low-NOx non-modulating <100kW   Alloc Rec, U GM	Global	2018	<b>Technology:</b> very good Process models average global technology <b>Time:</b> very good Data is <5 years old <b>Geography:</b> very good Data is representative of global conditions.
Diesel	ecoinvent 3.3: Heat, district or industrial, other than natural gas {RoW}  heat production, heavy fuel oil, at industrial furnace 1MW   Alloc Rec, U	Global	2018	<b>Technology:</b> very good Process models average global technology <b>Time:</b> very good Data is <5 years old <b>Geography:</b> very good Data is representative of global conditions.
Ancillary Materials and Packaging	LCI Data Source	Geography	Year	Data Quality Assessment
Pallets	ecoinvent 3.3: EUR-flat pallet {GLO}  market for   Alloc Rec, U UAE	Global	2018	<b>Technology:</b> very good Process models average global technology <b>Time:</b> very good Data is <5 years old <b>Geography:</b> very good Data is representative of global conditions.
Steel Straps	World Steel data for finished cold rolled coil	Global	2012	<b>Technology:</b> very good Process models average global technology <b>Time:</b> very good Data is 7 years old <b>Geography:</b> very good Data is representative of global conditions.





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Plastic Wrap	ecoinvent 3.3: Packaging film, low density polyethylene {GLO}  market for   Alloc Def, U Packaging	Global	2018	<b>Technology:</b> very good Process models average global technology <b>Time:</b> very good Data is <5 years old <b>Geography:</b> very good Data is representative of global conditions.
Lubricants	ecoinvent 3.3: Lubricating oil {GLO}  market for   Alloc Rec	Global	2018	<b>Technology:</b> very good Process models average global technology <b>Time:</b> very good Data is <5 years old <b>Geography:</b> very good Data is representative of global conditions.
<b>Water</b>	<b>LCI Data Source</b>	<b>Geography</b>	<b>Year</b>	<b>Data Quality Assessment</b>
<b>Municipal Water</b>	Modeled as elementary flow	N/A	N/A	N/A
<b>Waste</b>	<b>LCI Data Source</b>	<b>Geography</b>	<b>Year</b>	<b>Data Quality Assessment</b>
<b>Aluminium recycled</b>	Internally recycled	N/A	N/A	N/A

### 3.7 Period under Review:

Data was gathered for the primary material inputs used in the production of the extruded aluminium for calendar year 2018.

### 3.8 Allocation:

NAPCO 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.



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### 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.

## 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 summarizes 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)																			
Product			Construction Installation		Use								End-of-life					Benefits of Loads Beyond the System Boundary	
Raw Material supply	Transport	Manufacturing	Transport	Construction/Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-Construction/ Demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D	
x	x	x	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd



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**Table 3 Continued: Impact Assessment Results for 1 ton Extruded aluminium**

<b>LCIA Indicators</b>		<b>Unit</b>	<b>A1-A3 Total</b>
<b>GWP</b>	Global Warming Potential (climate change)	kg CO2-eq	1.73E+04
<b>ODP</b>	Ozone Depletion Potential	kg CFC-11-eq	1.05E-03
<b>AP</b>	Acidification Potential	kg SO2-eq	5.89E+01
<b>EP</b>	Eutrophication Potential	kg PO4-eq	9.20E+00
<b>POCP</b>	Photochemical Ozone Creation/Smog Potential	kg C2H4 eq	5.96E+00
<b>ADPE</b>	Abiotic Depletion Potential for Non-Fossil Resources	kg Sb eq	1.39E-02
<b>ADPF</b>	Abiotic Depletion Potential for Fossil Resources	MJ Surplus	2.37E+05
<b>Inventory Metrics – Resources</b>		<b>Unit</b>	<b>A1-A3 Total</b>
<b>PERE</b>	Use of renewable primary energy as energy	MJ	2.21E+03
<b>PERM</b>	Use of renewable primary energy as a material	MJ	0.00E+00
<b>PERT</b>	Total use of renewable primary energy	MJ	2.21E+03
<b>PENRE</b>	Use of non-renewable primary energy as energy	MJ	2.64E+05
<b>PENRM</b>	Use of non-renewable primary energy as a material	MJ	0.00E+00
<b>PENRT</b>	Total use of non-renewable primary energy	MJ	2.64E+05
<b>SM</b>	Use of secondary materials	kg	0.00E+00
<b>RSF</b>	Use of renewable secondary fuels	MJ	0.00E+00
<b>NRSF</b>	Use of non-renewable secondary fuels	MJ	0.00E+00
<b>FW</b>	Use of freshwater resources	m3	4.52E+01
<b>Inventory Metrics – Waste and Outputs</b>		<b>Unit</b>	<b>A1-A3 Total</b>
<b>HWD</b>	Disposed of Hazardous Waste	kg	0.00E+00
<b>NHWD</b>	Disposed of Non-Hazardous Waste	kg	0.00E+00
<b>RWD</b>	Disposed of Radioactive Waste	kg	0.00E+00
<b>CRU</b>	Components for Reuse	kg	0.00E+00
<b>MFR</b>	Materials for Recycling	kg	0.00E+00
<b>MER</b>	Materials for Energy Recovery	kg	0.00E+00
<b>EEE</b>	Exported Electrical Energy (Waste to Energy)	kg	0.00E+00
<b>ETE</b>	Exported Thermal Energy (Waste to Energy)	kg	0.00E+00



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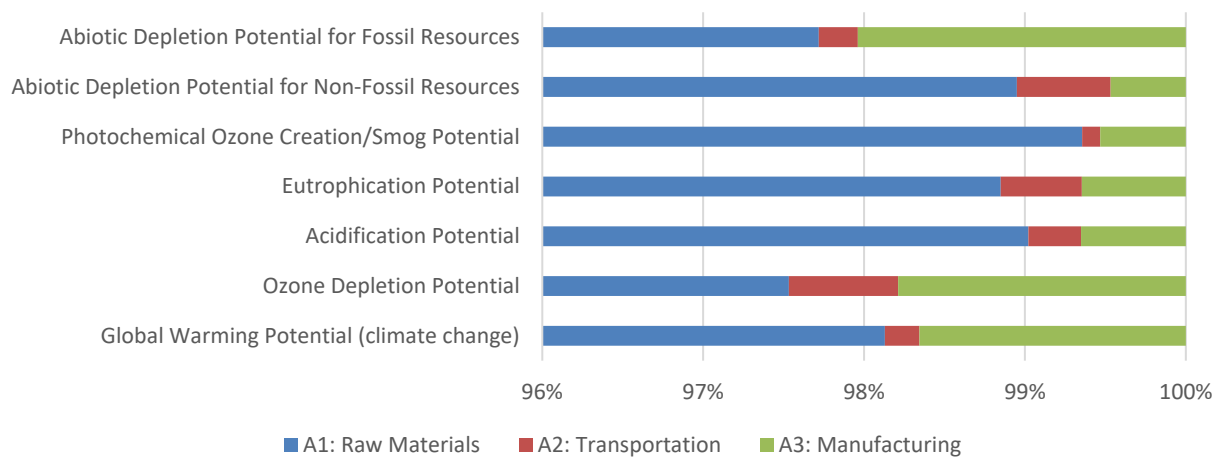
## Extruded Aluminum

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### 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 between 1-2% of impacts and no more than 3% combined in any impact category.

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



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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**

1. Athena Institute: 2019 - A Cradle-to-Gate Life Cycle Assessment of Extruded aluminium Manufactured by NAPCO. Background LCA report to this EPD.
2. EN 15804:2012 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.
3. IBU PCR Part A: Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project report – Version 1.3 (19.06.2014).
4. IBU PCR Part B: Requirements on the EPD for Products of aluminium and aluminium alloys – Version 1 (07.2014).
5. ISO 21930: 2017 Building construction – Sustainability in building construction – Environmental declaration of building products.
6. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
7. ISO 14044: 2006 Environmental management - Life cycle assessment - Requirements and guidelines.
8. ISO 14040: 2006 Environmental management - Life cycle assessment - Principles and framework.

