AMBICO™

SPECIALIZED DOORS · FRAMES · WINDOWS

Environmental Product Declaration

AMBICO Steel Door

ASTM INTERNATIONAL

EPD Summary

Product Name: Steel Door

Product Group: Commercial Steel Doors and/or Steel Frames

EPD Scope: Cradle-to-Gate

Declaration Holder: AMBICO

Program Operator: ASTM International

Declaration Number: EPD 066

Date of Issuance: August 30, 2017

End of Validity: August 30, 2022

Reference PCR: Underwriters Laboratory Product Category Rule (PCR) for Preparing an Environmental Product Declaration (EPD) for Product Group Commercial Steel Doors and/or Steel Frames; Version (March 10, 2015)

PCR Review: The reference PCR review was conducted by:

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Third Party Review: Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 21930:2007

LCA Reviewer:

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EPD Verifier:

Name: Timothy S. Brooke
Organization: ASTM International

Signature: 

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Product Description

For the purpose of this EPD, the term “AMBICO Steel Door” represents the full range of AMBICO’s steel swing doors. The EPD’s declared unit is a mass-weighted average of all steel swing doors manufactured at AMBICO’s Ottawa, Ontario facility. As such, this EPD applies to steel doors designed for acoustics, blast resistance, bullet resistance, fire rating, radio-frequency shielding, tornado, x-ray shielding, etc. It is equally applicable to doors made from galvannealed steel, galvanized steel, stainless steel, and decorative metal cladding with or without lite cutouts.

The declared unit is one steel door leaf with nominal dimensions of 3-feet by 7-feet (21 sq.ft. = 1.95m2) and a thickness of 1-3/4” (45mm). The product system is the A1-A3 Cradle-to-Gate production of the steel door product. It includes primary inputs to the steel door as well as the ancillary materials used in manufacturing and packaging the product. In accordance with the PCR governing commercial steel doors (UL 9005), this EPD does not cover lite kits, opening seals, door hardware, astragals, etc.

The geographic regions for which the LCA is representative include the Ontario, Canada region in which AMBICO’s facility resides, and also the entire geographic boundaries for AMBICO’s customers (North America).

Product Characterization
The steel door product is provided to the customer packed in cardboard and wood packaging materials. No installation services are included within the system boundary. No secondary equipment and/or accessories are included in the declared unit or product system. Additionally, manuals and other printed materials are included within the packaging.

Application
AMBICO (Steel Doors/Steel Frames/Wood Doors) are used in commercial, industrial, institutional, and government facilities. Project types include, but are not limited to, business, education, healthcare, detention, military, petrochemical, and residential. They may be used for new constructions projects, retrofits, and historic retrofits where the product must respect the existing look and feel.

Market Placement/Installation Requirements

AMBICO (Steel Doors/Steel Frames/Wood Doors) are made from materials conforming to, amongst others:

- ASTM A36/A36M: Standard Specification for Carbon Structural Steel
- ASTM A240/A240M: Standard Specification for Chromium and Chromium-Nickle Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- ASTM A500/A500M: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- ASTM A554: Standard Specification for Welded Stainless Steel Mechanical Tubing
- ASTM A653/A653M: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- ASTM B749: Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products

Technical Information

Thermal transmittance, air leakage, deflection/loading and outdoor-indoor sound attenuation information is not available for the average product group covered in this EPD. Product specifications and drawings are available at: https://www.ambico.com/acoustic-steel-doors-and-frames/. Contact AMBICO for additional technical information for specific products.

Delivery Status

The door frame product is shipped to the customer in the quantities specified in the declared unit definitions. The dimensions of the product are a 3’ x 7’ steel door.

Base Materials

The steel door is comrpised primarily of a product called galvanealed steel. This input is steel that has been galvanized and annealed. The portion of each material is shown in Table 1.

Table 1: Base Materials for Steel Door Declared Unit

Inputs	Amount
Galvanealed Steel	59.71%
Lead	11.59%
Stainless Steel	8.60%
Cold Rolled Coil	9.31%
Primer	5.60%
Adhesives	2.79%
Polystyrene Insulation	0.90%
Fiberglass Insulation	0.74%
Galvanized Steel	0.37%
Bronze	0.35%
Honeycomb Insulation	0.04%
Bolts and Nuts	0.00%

Environment and Health Considerations During Use

The steel door poses no signficant environmental or health considerations during the use phase.

Manufacturing

Steel doors are manufactured at AMBICO's Ottawa Ontario facility. The processing of raw material inputs into a finished steel door, packaged and ready for shipment, includes the following: Shearing the sheet metal components from, bending the metal into the required profiles, cutting the profiles with a miter saw, welding the profiles together, gluing and insulating, finishing, and packaging.

Packaging

Table 2 lists the packaging inputs that are included in the shipment of steel door to AMBICO's customers. Some packaging materials may be reused.

Table 2: Packaging Inputs

Input	Amount per declared unit	Unit
Plywood	7.35	kg
Lumber	9.74	kg
Plastic Roll	0.04	kg
Paper Roll	0.10	kg
Carboard Roll	0.42	kg
Steel Strap	0.03	kg

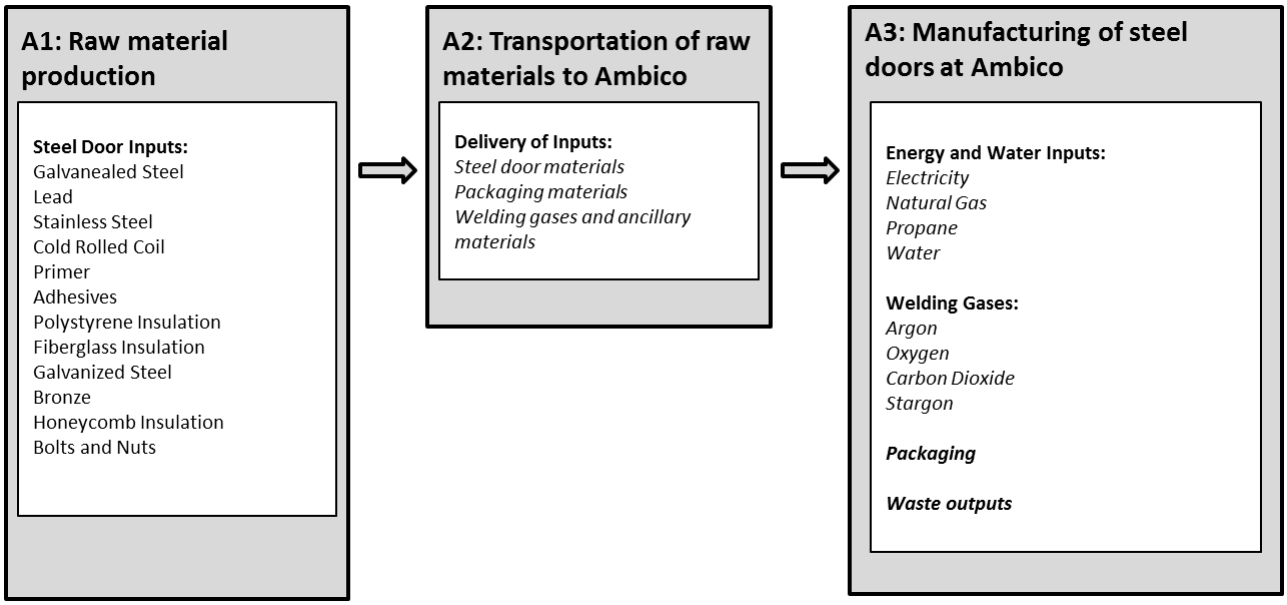
Life Cycle Assessment

Declared Unit
The declared unit is one 3' x 7' steel door – as Manufactured at AMBICO's Ottawa Ontario facility.

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 (see Figure1):

- A1- Raw material supply (upstream processes): extraction, handling, and processing of the steel and other raw materials.
- A2- Transportation: transportation of all input materials and fuels from the supplier to the gate of the manufacturing facility.
- A3- Manufacturing (core process): the energy used to store, move, weld, glue, insulate, assemble, and package the steel door product. Also includes the operations of the manufacturing facility as well as the transportation and processing of wastes from these core processes.

Figure 1: Cradle-to-gate product system for AMBICO steel door



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 finish options offered by AMBICO for their steel door product offerings.

Allocation
As prescribed by the UL PCR, the applied allocation procedures conform with ISO14044 clause 4.3.4. At the Ottawa ON facility, all the processing required (handling, fabricating, etc) specific to the door products were able to be reported separately by AMBICO and thus no allocation was required for the gate-to-gate manufacturing.

Cut-off Crtieria
The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO14044:2006 and section 3.3 of the governing PCR. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data were available were included in the calculated effects and no collected core process data were excluded.
- A one percent cut-off was considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total negleted flows did not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty were included;
- The cut-off rules were not applied to hazardous and toxic material flows – all of which were included in the life cycle flow inventory.

Background Data
All upstream material, resource and energy carrier inputs have been sourced from various industry-average datasets and literature. Care was taken to fill known data gaps as recorded in the US LCI database profiles.

Tables 3 through 5 describe each LCI data source[1] for raw materials (A1), transportation by mode (A2) and the core manufacture process (A3). Tables 3 through 5 also include a data quality assessment for all secondary data on the basis of the technological, temporal, and geographical representativeness as per Section 2.1.7 of the UL PCR.

[1] The dataset nomenclature contains regional abbreviations as follows: *RER: Europe; ROW: rest of world; NREL: National Renewable Energy Laboratory; U: unit process; CH: Switzerland; CA-ON: Ontario, Canada; RNA: North America; GLO: global.

Table 3: A1 – Raw Material Supply	
Materials	**LCI Data Source**
Galvanealed Steel	World Steel data for galvanized steel + anealing process from finished cold rolled coil
Stainless Steel	International Stainless Steel Forum
Cold Rolled Coil	World Steel data for finished cold rolled coil
Primer	USEI Database: Alkyd paint, white, 60% in solvent, at plant/RER with US electricity U
Lead	USEI Database: Lead, at regional storage/RER with US electricity U
Galvanized Steel	Worls Steel data for galvanized steel
Bronze	USEI Database: Bronze, at plant/CH with US electricity U
Adhesives	ecoinvent 3 Database: Adhesive, for metal {RoW}| production | Alloc Def, U
Bolts and Nuts	World Steel data for cold rolled coil
Polystyrene Insulation	USLCI Database: General purpose polystyrene, at plant NREL /RNA
Fiberglass Insulation	USEI Database: Glass wool mat, at plant/CH with US electricity U
Honeycomb Insulation	USEI Database: Polypropylene, granulate, at plant/RER with US electricity U

Table 4: A2 - Transportation	
Process	**LCI Data Source**
Road	USLCI 2014 – single unit truck transport, diesel powered, short haul US avg.;

Table 5: A3 - Manufacturing	
Energy	**LCI Data Source**
Electricity	ecoinvent 3 Database: Electricity, low voltage {CA-ON}| market for | Alloc Def, U
Natural Gas	USLCI 2014 Database: Natural gas, combusted in industrial boiler/US
Liquid Propane	USLCI 2014 Database: Liquefied petroleum gas, combusted in industrial boiler/US/l/RNA
Welding Gases	**LCI Data Source**
Argon	USEI Database: Argon, liquid, at plant/RER with US electricity U
Oxygen	USLCI 2014 Database: Oxygen, liquid, at plant/RNA
Carbon Dioxide	USEI Database: Carbon dioxide liquid, at plant/RER with US electricity U
Stargon	Blend of carbon dioxide, argon, and oxygen
Water	**LCI Data Source**
Municipal Water	Modeled as elementary flow
Packaging	**LCI Data Source**
Plywood	Athena data for Canadian average plywood
Lumber	Canadian average lumber LCA
Plastic Roll	ecoinvent 3 Database: Packaging film, low density polyethylene {GLO}| market for | Alloc Def, U
Paper Roll	ecoinvent 3 Database: Kraft paper, bleached {RoW}| production | Alloc Def, U
Carboard Roll	USEI Database: Corrugated board, mixed fibre, single wall, at plant/RER with US electricity U
Steel Strap	World Steel data for finished cold rolled coil
Polystyrene Strap	USLCI 2014 Database: Polystyrene, high impact, resin, at plant, CTR/kg/RNA
Waste	**LCI Data Source**
Steel scrap recycled	Transportation only as per PCR
Stainless steel recycled	Transportation only as per PCR
Lead recycled	Transportation only as per PCR
Solid waste and liquid waste landfilled	ecoinvent 3 Database: Process-specific burden, sanitary landfill {RoW}| processing | Alloc Def, U

Data Quality

Data quality requirements, as specified in the UL PCR section 2.1.7, are applied. This LCA and resulting EPD was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, efficiency and fuel types used. All LCI data (Tables 3 through 5) were assessed on the basis of the three data quality indicators listed below. Each indicator is interpreted with respect to its context and key determining data parameters.

Technical representativeness: Technical representativeness is the degree to which the data reflects the actual technology(ies) used. Core manufacturing process technology is derived from the manufacturing facilities and is highly representative. The secondary data for inputs to the manufacturing process are deemed to be reflective of typical or average technologies used by AMBICO in the production of doors and door frames. Some background material and process data are European but deemed to be similar to technologies used in the US.

Temporal representativeness: Temporal representativeness is the degree to which the data reflects the actual time (e.g. year) or age of the activity. Core manufacturing process data is based on activities for the year 2016. All other key LCI data sources are less than 10 years old.

Geographical representativeness: Geographical representativeness is the degree to which the data reflects the actual geographic location of the activity (e.g. country or site). Geographical coverage of core manufacturing processes is Ontario, Canada. Some material and process data are based on European sources (ecoinvent v3) while others are based on European data but modified where possible to incorporate North American upstream data (USEI).

Life Cycle Impact Assessment

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 UL PCR, Table 3, the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report and the US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), version 2.1, 2013 impact categories were used. Table 6 below summmarizes the LCA results for the cradle-to-gate (A1-A3) product system.

Table 6: LCA Results
Description of the System Boundary (x : included in LCA; mnd: module not declared)

Product			Construction Installation		Use							End-of-life				Benefits Beyond the System		
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

Table 6: LCA Results (Continued)		
Impact Assessment Results: A1-A3 Steel Door Declared Unit		
Environmental Indicator	**Unit**	**A1-A3 Total**
Global Warming Potential (climate change)	kg CO2 eq	4.22E+02
Ozone Depletion Potential	kg CFC-11 eq	1.09E-05
Acidification Potential	kg SO2 eq	2.68E+00
Eutrophication Potential	kg N eq	1.20E-01
Photochemical Ozone Creation/Smog Potential	kg O3 eq	2.25E+01
Abiotic Depletion Potential, ADP-Fossil Fuels	MJ Surplus	3.64E+02
Resource Use	**Unit**	**A1-A3 Total**
Use of renewable primary energy as energy	MJ	1.08E+02
Use of renewable primary energy as a material	MJ	0.00E+00
Total use of renewable primary energy	MJ	1.08E+02
Use of non-renewable primary energy as energy	MJ	5.81E+03
Use of non-renewable primary energy as a material	MJ	3.42E+02
Total use of non-renewable primary energy	MJ	6.16E+03
Use of secondary materials	kg	0.00E+00
Use of renewable secondary fuels	kg	0.00E+00
Use of non-renewable secondary fuels	kg	0.00E+00
Use of freshwater resources	m3	3.30E+00
Waste and Outputs	**Unit**	**A1-A3 Total**
Disposed of Hazardous Waste	kg	0.00E+00
Disposed of Non-Hazardous Waste	kg	1.48E+00
Disposed of Radioactive Waste	kg	0.00E+00
Components for Reuse	kg	0.00E+00
Materials for Recycling	kg	1.81E+01
Materials for Energy Recovery	kg	0.00E+00
Exported Thermal Energy (Waste to Energy)	kg	0.00E+00

Comparability of EPDs:

Full conformance with the PCR for Steel Door Frames and Steel Doors allows EPD comparability only when all stages of a Product System's life cycle have been considered. However, variations and deviations are possible.

Interpretation

Table 7 provides a contribution analysis of the impact assessment results by information module. Tables 8 and 9 the breakdown of the impacts caused by the two most signifcant cradle-to-gate modules as identified in Table 8. Table 9 shows the A1 breakdown and Table 10 shows the A3 breakdown.

Table 7: Interpretation (A1-A3) Steel Door Declared Unit

Environmental Indicator	Total	A1	A2	A3
Global Warming Potential (climate change)	100%	71%	0%	29%
Ozone Depletion Potential	100%	42%	0%	57%
Acidification Potential	100%	56%	0%	43%
Eutrophication Potential	100%	67%	1%	32%
Photochemical Ozone Creation/Smog Potential	100%	65%	2%	34%
Abiotic Depletion Potential, ADP-Fossil Fuels	100%	50%	1%	49%

Table 7 shows that the majority of the environmental burdens are generally driven by raw materials use (A1) relative to transportation (A2) and core manufacturing (A3) of the steel door.

Table 8: Interpretation (A1) Steel Door Declared Unit

Environmental Indicator	Total	Steel	Other
Global Warming Potential (climate change)	100%	81%	19%
Ozone Depletion Potential	100%	0%	100%
Acidification Potential	100%	60%	40%
Eutrophication Potential	100%	35%	65%
Photochemical Ozone Creation/Smog Potential	100%	57%	43%
Abiotic Depletion Potential, ADP-Fossil Fuels	100%	48%	52%

Table 8 shows that the steel drives the impacts in every category except ozone depletion potential. The overall scale of ozone depletion potential emissions is insignficant which results in skewed results for this impact category indicator.

Table 9: Interpretation (A3) Steel Door Frame Declared Unit

Environmental Indicator	Total	Energy	Welding Gases	Other
Global Warming Potential (climate change)	100%	68%	28%	3%
Ozone Depletion Potential	100%	82%	16%	1%
Acidification Potential	100%	70%	25%	5%
Eutrophication Potential	100%	82%	13%	6%
Photochemical Ozone Creation/Smog Potential	100%	51%	37%	12%
Abiotic Depletion Potential, ADP-Fossil Fuels	100%	86%	14%	1%

Table 9 indicates that the energy use at the Ottawa facility drives the A3 impacts. Welding gases also contribute significantly to the various impact category indicators.

References

1. Athena Institute: 2017 - A Cradle-to-Gate Life Cycle Assessment of Door and Door Frames Manufactured by AMBICO. 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. ISO 21930: 2007 Building construction – Sustainability in building construction – Environmental declaration of building products.
4. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
5. ISO 14044: 2006 Environmental management - Life cycle assessment - Requirements and guidelines.
6. ISO 14040: 2006 Environmental management - Life cycle assessment - Principles and framework.
7. National Renewable Energy Laboratory 2014. U.S. Life Cycle Inventory Database. https://www.lcacommons.gov/nrel/search.
8. UL 9005: Product Category Rule (PCR) for Preparing an Environmental Product Declaration (EPD) for Product Group Commercial Steel Doors and/or Steel Frames; Version March 10, 2015.
9. U.S. EI Database (2012). Earthshift and ecoinvent (ecoinvent 2.2; modified with US electricity). Published and packaged with SimaPro.
10. U.S. Life Cycle Inventory Database." (2012). National Renewable Energy Laboratory, 2012. Accessed August 29, 2017: https://www.lcacommons.gov/nrel/search
11. Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230. Available at: <http://link.springer.com/10.1007/s11367-016-1087-8> [Accessed 29 08 2017].