Environmental Product Declaration for

QMI Steel Doors

Product Name: Steel Door

Product Group: Commercial Steel Doors and/or Steel Frames

EPD Scope: Cradle-to-Gate

Declaration Holder: QMI

Program Operator: ASTM International

Declaration Number: EPD 089

Date of Issuance: February 7, 2019

End of Validity: February 7, 2024

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

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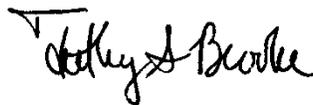
Product Description

For the purpose of this EPD, the term "QMI Steel Door" represents the full range of QMI's steel swing doors. The EPD's declared unit is a mass-weighted average of all steel swing doors manufactured at QMI's Dubai, UAE facility. As such, this EPD applies to products branded Eco Doors, Guardian Sheild HD Doors, Silencio and Guardian Security Doors.

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 Dubai, UAE region in which QMI's facility resides, and also the entire geographic boundaries for QMI's customers.

Product Characterization
The steel door product is provided to the customer packed in on pallets and secured with steel straps. 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
QMI Steel 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.

Market Placement/Installation Requirements

QMI Steel 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 are available at: http://www.qmidoors.com/qmi-products.html. Contact QMI for additional technical information for specific products.

Delivery Status

The door 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 galvanized steel. The portion of each material is shown in Table 1.

Table 1: Base Materials for Steel Door Declared Unit	
Inputs	**Amount**
Galvanized Steel	94.08%
Rockwool	2.66%
Powder Coating	1.50%
Kraft Paper	0.87%
Adhesives	0.89%

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 QMI's Dubai, UAE 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 QMI's customers. Some packaging materials may be reused.

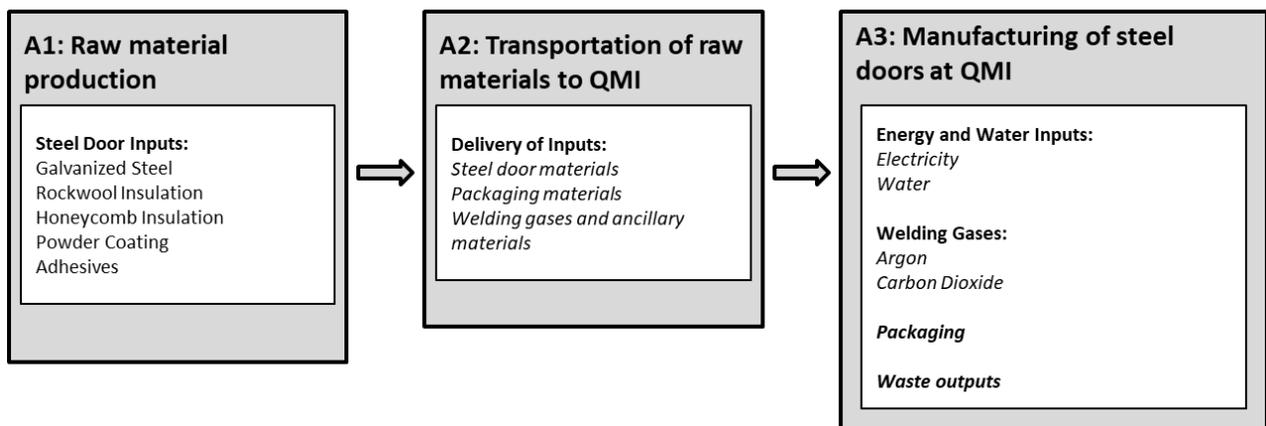| Table 2: Packaging Inputs		
Input	**Amount per declared unit**	**Unit**
Wood Pallets	2.22	kg
Steel Strap	0.05	kg

Life Cycle Assessment

Declared Unit

The declared unit is one 3' x 7' steel door – as Manufactured at QMI's Dubai, UAE 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 QMI steel doors

A1: Raw material production

Steel Door Inputs:
Galvanized Steel
Rockwool Insulation
Honeycomb Insulation
Powder Coating
Adhesives

⇨

A2: Transportation of raw materials to QMI

Delivery of Inputs:
Steel door materials
Packaging materials
Welding gases and ancillary materials

⇨

A3: Manufacturing of steel doors at QMI

Energy and Water Inputs:
Electricity
Water

Welding Gases:
Argon
Carbon Dioxide

Packaging

Waste outputs

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 QMI 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 Dubai facility, all the processing required (handling, fabricating, etc) specific to the door products were able to be reported separately by QMI 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.

Table 3 describes each LCI data source for raw materials (A1), transportation by mode (A2) and the core manufacture process (A3). Table 3 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.

Table 3: Secondary Data Sources and Data Quality Assessment				
A1: Raw Material Inputs				
Inputs	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Galvanized Steel	World Steel data for galvanized steel	Global	2017	**Technology:** very good Process models average global technology **Time:** very good Data is less than 5 years old **Geography:** very good Data is representative of global production.
Rockwool Insulation	ecoinvent 3.3: Rock wool {GLO}| market for | Alloc Def, U	Global	2016	**Technology:** very good Process models average global technology **Time:** very good Data is less than 5 years old **Geography:** very good Data is representative of global production.
Honeycomb Insulation	ecoinvent 3.3: Kraft paper, unbleached {GLO}| market for | Alloc Def, U	Global	2016	**Technology:** very good Process models average global technology **Time:** very good Data is less than 5 years old **Geography:** very good Data is representative of global production.

Adhesives	ecoinvent 3.3 Database: Adhesive, for metal {RoW}| production	Alloc Def, U	Global	2016	**Technology:** very good Process models average global technology **Time:** very good Data is less than 5 years old **Geography:** very good Data is representative of global production.
Powder Coating	ecoinvent 3.3: Electrostatic paint {GLO}| market for	Alloc Def, U	Global	2016	**Technology:** very good Process models average global technology **Time:** very good Data is less than 5 years old **Geography:** very good Data is representative of global production.

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	Alloc Def, U	Global	2016	**Technology:** very good Process models average global technology **Time:** very good Data is less than 5 years old **Geography:** very good Data is representative of global trucking.
Ocean Transport	ecoinvent 3.3: Transport, freight, sea, transoceanic ship {GLO}| market for	Alloc Def, U	Global	2016	**Technology:** very good Process models average global technology **Time:** very good Data is less than 5 years old **Geography:** very good Data is representative of global ocean freight.

A3: Manufacturing				
Energy	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Electricity	Energy source breakdown: International Energy Agency electricity statistics for 2014 UAE electricity generation Electricity generation processes: ecoinvent 3.3 (specific LCI Data Sets listed below)	UAE/Global	2016	**Technology**: very good Process models average UAE technology **Time**: very good Data is less than 5 years old **Geography**: very good Data is representative of UAE electricity.
Welding Gases	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Argon	ecoinvent 3.3: Argon, liquid, at plant/RER | Alloc Def, U	Global	2016	**Technology:** very good Process models average global technology **Time:** good Data is less than 5 years old. **Geography:** very good Data is representative of global conditions.
Carbon Dioxide	USEI Database: Carbon dioxide liquid, at plant/RER with US electricity U	Europe with US Electricity	2016	**Technology**: fair Process models average European technology **Time**: good Data is less than 5 years old **Geography**: fair Data is representative of European production, modified with UAE electricity.
Water	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Municipal Water	ecoinvent 3.3: Tap water {GLO}| tap water production, seawater reverse osmosis, conventional pretreatment, enhance module, single stage | Alloc Rec Modified With UAE Electrcity	UAE/Global	2016	**Technology**: very good Process models average UAE technology **Time**: very good Data is less than 5 years old **Geography**: very good Data is representative of UAE water.

Packaging	LCI Data Source	Geography	Year	Data Quality Assessment
Pallets	Sawnwood, softwood, kiln dried, planed {RoW}| market for	Alloc Def, U	Global	2016	**Technology:** very good Process models average global technology **Time:** good Data is less than 5 years old. **Geography:** very good Data is representative of global conditions.
Steel Strap	World Steel Data for Finished Cold Rolled Coil Steel	Global	2017	**Technology:** very good Process models average global technology **Time:** very good Data is less than 5 years old **Geography:** very good Data is representative of global production.
Waste	LCI Data Source	Geography	Year	Data Quality Assessment
Steel scrap recycled	Transportation only (see A2 trucking)	-	-	-
Powder recycled	Transportation only (see A2 trucking)	-	-	-
Solid waste and liquid waste landfilled	ecoinvent 3.3 Database: Process-specific burden, sanitary landfill {RoW}| processing	Alloc Def, U	Global	2014	**Technology**: very good Process models average global technology **Time**: very good Data is less than 5 years old **Geography**: very good Data is representative of global processes.

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 (Table 3) was 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 QMI in the production of doors.

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 2017. 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 Dubai, UAE. Some material and process data are based on global sources (ecoinvent v3) while and were modified where possible to incorporate the UAE-specific electricity grid.

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, the CML Impact Assessment method was used to calculate the impacts. 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	3.15E+02
Ozone Depletion Potential	kg CFC-11-eq	5.77E-06
Acidification Potential	kg SO2-eq	9.70E-01
Eutrophication Potential	kg PO4-eq	8.72E-02
Photochemical Ozone Creation/Smog Potential	kg C2H4 eq	1.16E-01
Abiotic Depletion Potential for Non-Fossil Resources	kg Sb eq	1.29E-04
Abiotic Depletion Potential for Fossil Resources	MJ Surplus	3.55E+03
Resource Use	**Unit**	**A1-A3 Total**
Use of renewable primary energy as energy	MJ	6.50E-05
Use of renewable primary energy as a material	MJ	0.00E+00
Total use of renewable primary energy	MJ	6.50E-05
Use of non-renewable primary energy as energy	MJ	3.47E+03
Use of non-renewable primary energy as a material	MJ	0.00E+00
Total use of non-renewable primary energy	MJ	3.47E+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	2.35E+00
Waste and Outputs	**Unit**	**A1-A3 Total**
Disposed of Hazardous Waste	kg	0.00E+00
Disposed of Non-Hazardous Waste	kg	1.96E-02
Disposed of Radioactive Waste	kg	0.00E+00
Components for Reuse	kg	0.00E+00
Materials for Recycling	kg	0.00E+00
Materials for Energy Recovery	kg	0.00E+00
Exported Thermal Energy (Waste to Energy)	kg	0.00E+00

ASTM INTERNATIONAL

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. The majority of impacts are caused

Table 7: Interpretation (A1-A3) Steel Door Declared Unit				
Environmental Indicator	Total	A1	A2	A3
Global Warming Potential (climate change)	100%	85%	8%	8%
Ozone Depletion Potential	100%	17%	53%	30%
Acidification Potential	100%	82%	6%	13%
Eutrophication Potential	100%	67%	5%	27%
Photochemical Ozone Creation/Smog Potential	100%	93%	3%	3%
Abiotic Depletion Potential for Non-Fossil Resources	100%	40%	8%	52%
Abiotic Depletion Potential for Fossil Resources	100%	78%	12%	11%

Table 7 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. The impact categories global warming potential, abiotic resource depletion, eutrophication potential, smog creation potential, and acidification are dominated by A1: raw material supply. These impacts are caused by the upstream production of the material inputs into the products and account for more than 50% of impacts in the various impact categories.

References

1. Athena Institute: 2018 - A Cradle-to-Gate Life Cycle Assessment of Steel Doors Manufactured by QMI. 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. 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.
8. 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].