Environmental Product Declaration

Metal Building Insulation (MBI)

MBI Manufactured in Mexico City, Mexicali, and Monterrey





Owens Corning® MBI products are light-density fibrous glass blankets, designed for use in metal buildings.

Owens Corning, and its family of companies, are a leading global producer of residential and commercial building materials, glass fiber reinforcements, and engineered materials for composite systems. It uses a decision framework for managing the company as a sustainable enterprise. It is the foundation of the company's strategy of building market-leading businesses, global in scope – human in scale, and reflects the company's purpose: our people and products make the world a better place.

Owens Corning is committed to balancing economic growth with social progress and sustainable solutions to its building materials and composite customers around the world.

This Environmental Product Declaration is a component of our stated goal to provide life cycle information on all core products.

sustainability.owenscorning.com

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

ENVIRONMENTAL PRODUCT DECLARATION

MBI Manufactured in Mexico City, Mexicali, and Monterrey

According to ISO 14025, EN 15804, and ISO21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL ENVIRONMENT 333 PFINGSTEN RD, NORTHBROOK, IL 60062	WWW.UL.COM WWW.SPOT.UL.COM
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	Program Operator Rules v 2.7 2022	
MANUFACTURER NAME AND ADDRESS	Owens Corning Mexico, S. de R.L. de C.V. Acueducto 1555 San Rafael Ticoman, C.P. 07359, Gustavo A Madero, Ciudad de México	
DECLARATION NUMBER	4790365982.102.1	
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	1 m^2 insulation at R_{SI}=1	
REFERENCE PCR AND VERSION NUMBER	Part B: Building Envelope Thermal Insulation EPD Requirements, UL 10010–1, version 2.0	
DESCRIPTION OF PRODUCT APPLICATION/USE	Metal Building Insulation (MBI) products are installed in metal budiling roofs and walls to provide thermal insulation.	
PRODUCT RSL DESCRIPTION (IF APPL.)	75 years	
MARKETS OF APPLICABILITY	North America	
DATE OF ISSUE	December 1, 2022	
PERIOD OF VALIDITY	5 Years	
EPD TYPE	Product-specific	
RANGE OF DATASET VARIABILITY	NA	
EPD SCOPE	Cradle to gate with options (A1-A3, A4, A5, C2, C4)	
YEAR(S) OF REPORTED PRIMARY DATA	2021	
LCA SOFTWARE & VERSION NUMBER	SimaPro 9.4	
LCI DATABASE(S) & VERSION NUMBER	ecoinvent 3.8	
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1 v1.05; CML I-A baseline v4.7; IPCC (2021)	

The PCR review was conducted by:	UL Environment PCR Review Panel epd@ul.com
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒ EXTERNAL	Cooper McC Cooper McCollum, UL Environment
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Aspire Sustainability
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria, Industrial Ecology Consultants

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

1. Product Definition and Information

1.1. Description of Company/Organization

Founded in 1938, Owens Corning is a leader in insulation, roofing and fiberglass composites. It has a global presence with 20,000 people in 33 countries. Product covered by this Environmental Product Declaration was produced in the following locations:

Mexico City Plant Mexico City, Mexico 07359
Mexicali Plant Mexicali, Baja California, Mexico 21607
Monterrey Plant Santa Cantina, Nuevo Leon, Mexico 66350

1.2. Product Description

Product Identification

Owens Corning® Metal Building Insulation (MBI) products are light-density fibrous glass blankets with excellent recovery, designed to be laminated with appropriate facings for use in metal building roofs and walls. MBI is available from Mexico in standard R-values of 7, 8, 10, 11, 13, 15, 16, 19, 21, 22, 25, and 30. Standard roll widths are 50” and 72” (127 cm and 183 cm, respectively). Finished MBI products are available in a variety of densities, thicknesses, R-values and laminating capabilities to meet a variety of building needs and code requirements. Finished MBI products have an average total recycled content of 53%. The Mexico City plant manufactures fiberglass insulation. Polypropylene reinforced facings are applied to the fiberglass in Mexico City, Mexicali, and Monterrey plants.



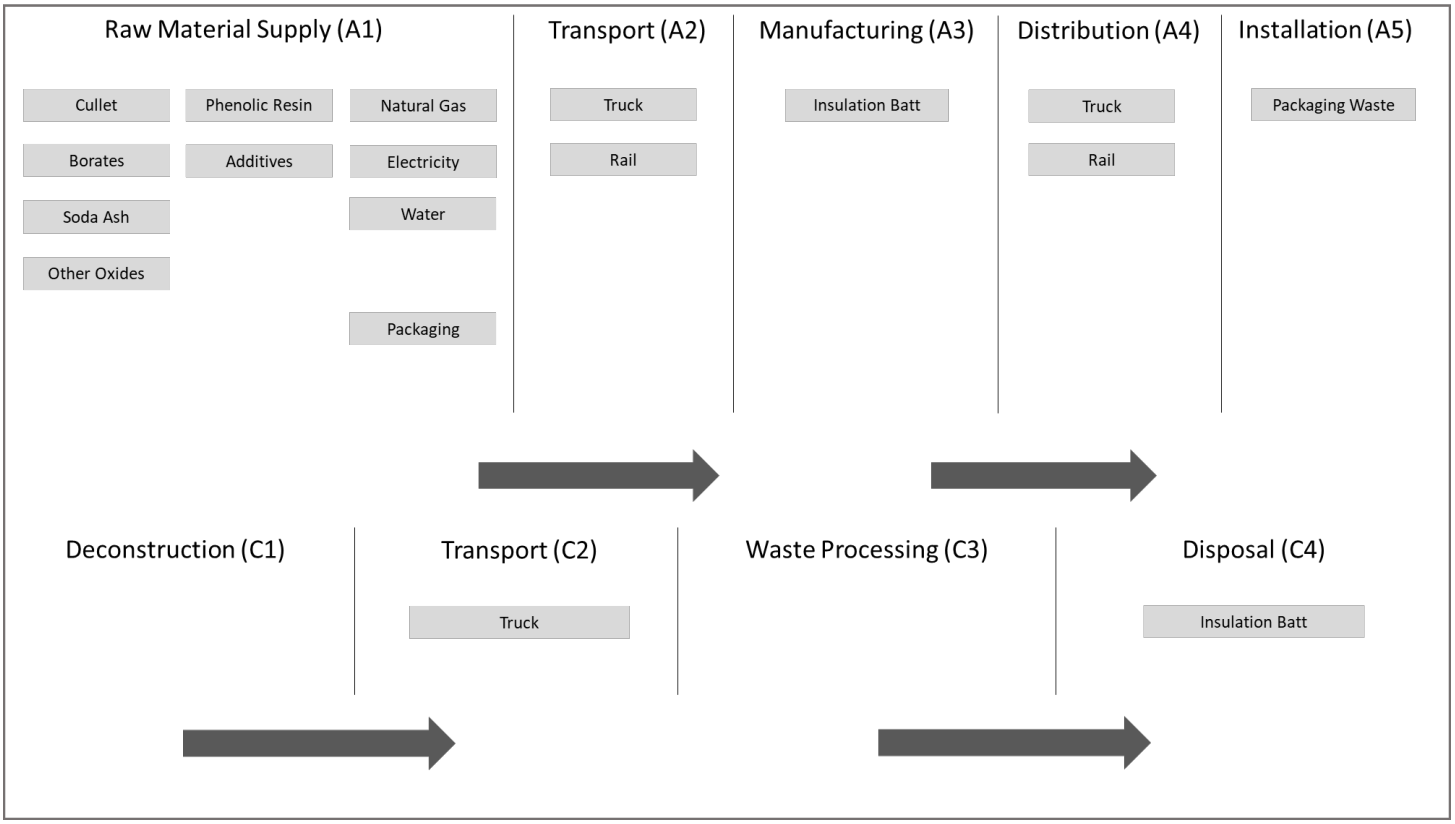
Product Specification

Table 1. Physical Properties of MBI

PROPERTY	TEST METHOD	VALUE		
		THICKNESS		THERMAL RESISTANCE
		CM	IN	
Thermal Resistance	ASTM C 177/C 518	5.1	2.0	R-7
		7.6	3.0	R-10
		8.9	3.5	R-11
		10.2	4.0	R-13
		11.4	4.5	R-15
		12.7	5.0	R-16
		15.2	6.0	R-19
		16.5	6.5	R-21
		17.8	7.0	R-22
		20.3	8.0	R-25
		24.1	9.5	R-30
Surface Burning[1]	ASTM E 84 / UL723[2]	Flame spread index ≤ 25 Smoke developed index ≤ 50		
Combustion Characteristics[3]	ASTM E136	Non-combustible		
Water Vapor Sorption	ASTM C 1104 / C 1104M	<0.2% by volume		
Fungi Resistance	ASTM C 1338	Passes		
Corrosiveness	ASTM C665	Passes		
Odor Emission	ASTM C 1304	Passes		
Dimensional Tolerances	ASTM C 167	Length: - 0 cm Width: ± 0.5 cm		

1. This test was conducted using faced product.
2.This standard is not intended to address all safety concerns associated with the use of these products. It is the responsibility of the user of these products to establish appropriate safety and health practices and act in accordance with all applicable regulatory limitations.
3. This test was conducted using finished product.

Flow Diagram



Product Average

The results of this declaration represent an average performance for the listed products. Reported area weights for included products and production locations were taken from quality control data to create a weighted average which was used to determine the functional unit mass for the LCA.

1.3. Application

Owens Corning® MBI is used for thermal insulation in the roofs and side walls of metal buildings. The finished product is laminated with a polypropylene reinforced facing to provide attractive interior finishes, abuse resistance, and assistance in control of moisture.

1.4. Declaration of Methodological Framework

This declaration is a product-specific EPD. It is cradle-to-gate with modules A1-A5 and end-of-life included. The LCA study included the following:

- Raw materials including extraction, production, packaging and recycle cullet
- Transportation of raw materials to the manufacturing facility
- Fiberglass manufacturing
- Finished goods transportation
- Installation in the building
- End-of-life, including transport to landfill and landfill disposal

No known flows are deliberately excluded from this EPD.

The product is expected to last for at least the 75 years reference service life if it remains clean and dry in its installed state.

1.5. Technical Requirements

Compliance

- MBI is manufactured in compliance with ASTM C991-08, Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings; Type II

1.6. Properties of Declared Product as Delivered

MBI is delivered with a polypropylene reinforced facing in rolls. Once removed from the packaging, the product will recover to the needed thickness to deliver the advertised R-value.

1.7. Material Composition

Metal Building Insulation products consist of two major components: fiberglass (nominally ≥ 85%) and the remainder being the add-on chemcials for binder. The fiberglass is made from various inorganic minerals, which are referred to as batch chemcials. The binder system consists of organic materials.

The MBI products included in this study use phenol-urea-formaldehyde (PUF) binder.

Table 2. Material Content for MBI®

MATERIALS	FUNCTION	QUANTITY (% BY MASS)
Cullet	Glass Batch	40-85%
Borates	Glass Batch	5-15%
Soda Ash	Glass Batch	<10%
Other Oxides	Glass Batch	<5%
Resin	Binder	<5%
Urea	Binder	<5%
Additives	Binder	<1%

MBI is laminated with a polypropylene reinforced facing material prior to delivery to customers; the environmental impact of the facing material is included in the scope of this EPD and the underlying LCA.

Table 3. Material Content for Facing

MATERIALS	FUNCTION	QUANTITY (% BY MASS)
Polypropylene Scrim Kraft	Facing	50-80%
Adhesive	Facing	20-40%

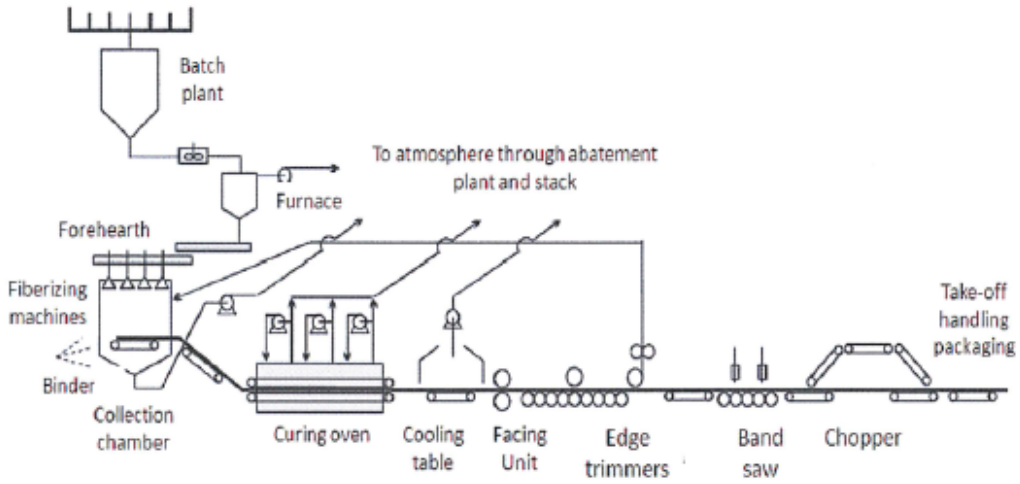
1.8. Manufacturing

Owens Corning North American Insulation manufacturing locations can be found across the continent. However, the scope of this study includes only fiberglass blanket insulation for MBI manufactured at the following location:

Mexico City Plant Mexico City, Mexico 07359

The fiberglass blanket insulation is laminated with a polypropylene reinforced facing to produce finished MBI product at the following locations:

Mexico City Plant Mexico City, Mexico 07359
Mexicali Plant Mexicali, Baja California, Mexico 21607
Monterrey Plant Santa Cantina, Nuevo Leon, Mexico 66350



The diagram above is representative for the manufacturing of bonded fiberglass insulation product.

1.9. Packaging

MBI products are packaged in printed bags, made of low-density polyethylene with the addition of type A post-production material (recycled material). Due to a lack of a disposal scenario specific to Mexico in the PCR, the United States scenario was chosen as the best representation from North America. The following packaging disposal scenarios are assumed, in accordance with the PCR.

Table 4. Packaging Material Disposal Scenarios (North America)

Country/Region	Material Type	Recycling Rate	Landfill Rate	Incineration Rate
United States	Plastics	15%	68%	17%
	Metals	57%	34%	9%
	Pulp (cardboard, paper)	75%	20%	5%

1.10. Transportation

The outbound transportation or distribution includes the transportation of the finished product to customers primarily by diesel semi-truck. The weighted average distance from each of the manufacturing sites to the customer is provided in Table 5.

Table 5. Average Outbound Transportation Distances.

LOCATION	OUTBOUND AVERAGE DISTANCE
Mexico City	70.1 km
Mexicali	153 km
Monterrey	67.1 km

1.11. Product Installation

Several methods are used to insulate metal buildings. The usual method is to apply the insulation over the structural members (purlins and girts) and inside the exterior panels. This method generally accommodates single layer installations. Methods are also available to apply insulation between purlins so as to accommodate greater insulation thicknesses and better thermal performance.

1.12. Use

Insulation is a passive device that requires no extra utlities or maintenance to operate over its useful life.

1.13. Reference Service Life and Estimated Building Service Life

The product is assumed to remain in service for the life of the building, 75 years.

1.14. Reuse, Recycling, and Energy Recovery

MBI can be reused if remains clean and dry. Recycling programs do not currently exist for fiberglass insulation.

1.15. Disposal

It was assumed that all materials removed from the decommissioning of a building were taken to a local construction waste landfill, using 161 km (100 miles) as the average distance to landfill.

2. Life Cycle Assessment Background Information

2.1. Functional or Declared Unit

The functional unit is 1 m^2 of insulation material with a thickness that gives an average thermal resistance R_{SI}=1 m^2K/W and with a building service life of 75 years.

Table 6. Functional Unit Specifications for Unfaced MBI

NAME	MBI	
Functional Unit	1 m^2 of insulation material with a thickness that gives an average thermal resistance R_{SI}=1 m^2K/W	
Mass	4.07E-01	kg
Thickness to achieve Functional Unit	4.10E-01	m

Faced insulation additionally has 1 m2 of a facing which is applied to the top surface of the insulation material. For this study, the declared unit for facing is 1 m2 for the 1 m2 functional unit of insulation.

Table 7. Declared Unit Specifications for Polypropylene Scrim Kraft Facing

NAME	POLYPROPYLENE SCRIM KRAFT FACING	
Declared Unit	1 m^2 of facing	
Mass	8.30E-02	kg
Thickness	2.03E-04	m

2.2. System Boundary

This EPD is cradle-to-installation with end-of-life. Details of the system boundaries may be found in the diagram below.

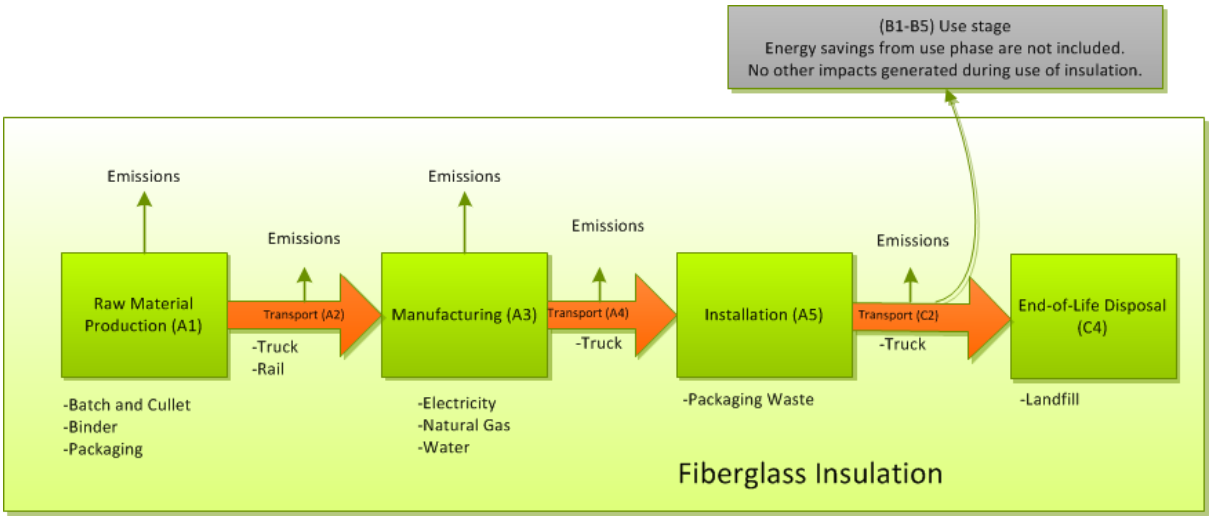


Figure 1. Insulation System Boundary

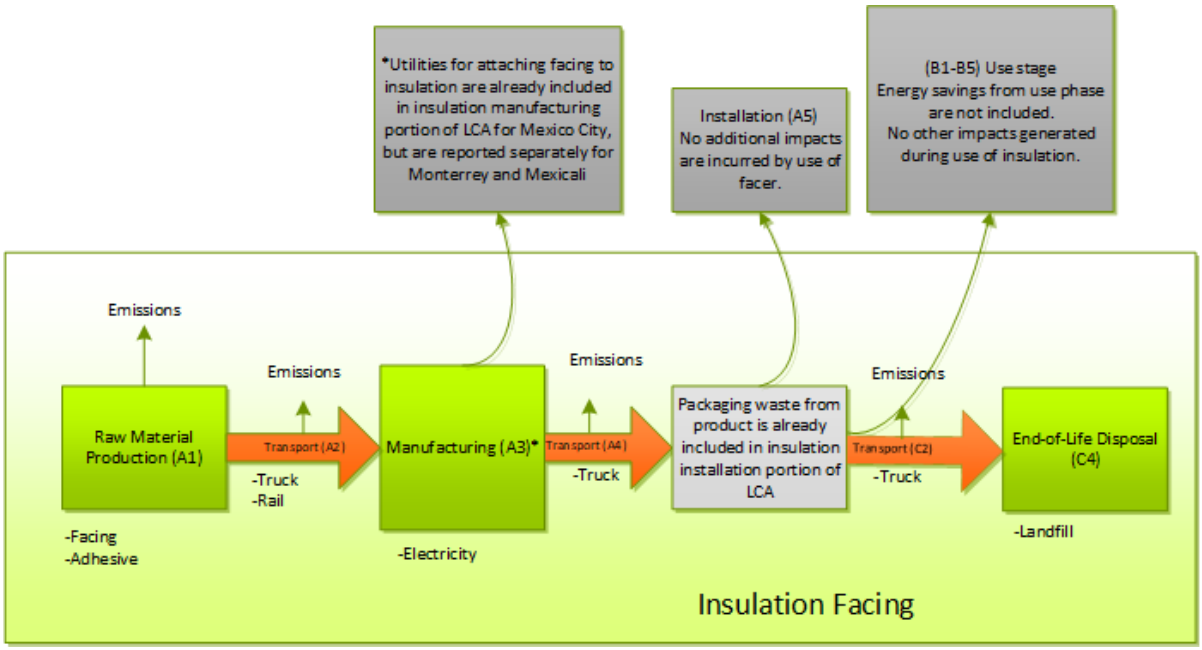


Figure 2. Insulation Facing System Boundary

2.3. Estimates and Assumptions

Since insulation is a passive device, it is assumed that no utility source or maintenance is needed during the use stage. It is assumed the product remains in service for the 75-year reference service life.

2.4. Cut-off Criteria

This LCA is in compliance with the cutoff criteria specified in the PCR. Due to the long lifetime of equipment, capital goods and infrastructure flows were excluded as having a negligible impact on the conclusions of the LCA.

2.5. Data Sources

Primary manufacturing data was collected from the included manufacturing locations listed in the Manufacturing section. Secondary data primarily references the ecoinvent 3.8 database.

2.6. Data Quality

Primary data was based on measured and calculated data from the Owens Corning plants in Mexico City, Mexicali, and Monterrey, and reflects production of the included products between January 1, 2021 and December 31, 2021. It meets requirements for completeness along with temporal, geographical and technological representativeness. Background data was taken primarily from the ecoinvent 3.8 database, which is on the approved database list in the PCR. As much as reasonable, selected background datasets represent the situation in 2021 and 2022 and are no more than ten years old. In practice, older data have been used where more recent data were not available. In such cases the datasets were evalutated for reasonableness and deemed suitable for this LCA study given that technology advances have likely not occurred for these specific materials and processes.

2.7. Period under Review

Owens Corning manufacturing data reflects production of the included products between January 1, 2021 and December 31, 2021.

2.8. Allocation

Where it was not possible to avoid allocation, allocation was made based on product mass.

3. Life Cycle Assessment Scenarios

Table 8. Insulation Product Transport to the building site (A4)

NAME	MEXICO CITY	MEXICALI	MONTERREY	UNIT
Fuel type		Low-sulfur diesel		
Liters of fuel	1.77E-03	1.77E-03	1.77E-03	l/100km
Vehicle type	Transport, freight, lorry >32 metric ton, EURO5 {RoW}| transport, freight, lorry >32 metric ton, EURO5			
Transport distance	7.01E+01	1.53E+02	6.71E+01	km
Capacity utilization (including empty runs, mass based		63%		%
Gross density of products transported	9.93E+00	9.93E+00	9.93E+00	kg/m^3
Weight of products transported (if gross density not reported)	4.07E-01	4.07E-01	4.07E-01	kg
Volume of products transported (if gross density not reported)	4.10E-02	4.10E-02	4.10E-02	m^3
Capacity utilization volume factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaging products)	1	1	1	-

Table 9. Facing Transport to the building site (A4)

NAME	MEXICO CITY	MEXICALI	MONTERREY	UNIT
Fuel type		Low-sulfur diesel		
Liters of fuel	4.78E-04	5.71E-04	5.71E-04	l/100km
Vehicle type	Transport, freight, lorry >32 metric ton, EURO5 {RoW}| transport, freight, lorry >32 metric ton, EURO5			
Transport distance	7.01E+01	1.53E+02	6.71E+01	km
Capacity utilization (including empty runs, mass based		63%		%
Gross density of products transported	4.09E+02	4.09E+02	4.09E+02	kg/m^3
Weight of products transported (if gross density not reported)	8.30E-02	8.30E-02	8.30E-02	kg
Volume of products transported (if gross density not reported)	2.03E-04	2.03E-04	2.03E-04	m^3
Capacity utilization volume factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaging products)	1	1	1	-

Table 10. Installation into the building (A5)

NAME	MEXICO CITY	MEXICALI	MONTERREY	UNIT
Ancillary materials	0.00E+00	0.00E+00	0.00E+00	kg
Net freshwater consumption	0.00E+00	0.00E+00	0.00E+00	m^3
Other resources	0.00E+00	0.00E+00	0.00E+00	kg
Electricity consumption	0.00E+00	0.00E+00	0.00E+00	kWh
Other energy carriers	0.00E+00	0.00E+00	0.00E+00	MJ
Product loss per functional unit	0.00E+00	0.00E+00	0.00E+00	kg
Waste materials at the construction site before waste processing, generated by product installation	9.63E-06	6.63E-06	8.59E-06	kg
Output materials resulting from on-site waste processing	0.00E+00	0.00E+00	0.00E+00	kg
Biogenic carbon contained in packaging	0.00E+00	0.00E+00	0.00E+00	kg CO_2
Direct emissions to ambient air, soil and water	0.00E+00	0.00E+00	0.00E+00	kg
VOC content	Unknown	Unknown	Unknown	$\mu g/m^3$

Table 11. Reference Service Life for Metal Building Insulation products

REFERENCE SERVICE LIFE	VALUE	UNIT	COMMENT
RSL	75	years	
Declared product properties (at gate) and finishes, etc.	Not applicable		Insulation properties require installation.
Design application parameters	Install per instructions		
An assumed quality of work, when installed in accordance with manufacturer's instructions	Will meet R-value		Installer should install per manufacturer instructions
Outdoor environment	Not applicable		Indoor application
Indoor environment	Product should be kept dry		
Use conditions	Not applicable		Insulation is a passive product which is not used directly during life
Maintenance	None needed		Insulation does not need maintenance during its use

Table 12. End of Life Transport (C2) and Landfill Disposal (C4) of Insulation Products

END OF LIFE (C2, C4)		MEXICO CITY	MEXICALI	MONTERREY	UNIT
Collection process (specified by type)	Collected separately	0.00E+00	0.00E+00	0.00E+00	kg
	Collected with mixed construction waste	4.07E-01	4.07E-01	4.07E-01	kg
Disposal (Landfill)	Product or material for final deposition	4.07E-01	4.07E-01	4.07E-01	kg
Transport to Disposal	Diesel Powered Truck	1.61E+02	1.61E+02	1.61E+02	km
Removals of biogenic carbon (excluding packaging)		0.00E+00	0.00E+00	0.00E+00	kg CO_2 eq

Table 13. End of Life Transport (C2) and Landfill Disposal (C4) of Insulation Facing

END OF LIFE (C2, C4) – FACING ADDONS		MEXICO CITY	MEXICALI	MONTERREY	UNIT
Collection process (specified by type)	Collected separately	0.00E+00	0.00E+00	0.00E+00	kg
	Collected with mixed construction waste	8.30E-02	8.30E-02	8.30E-02	kg
Disposal (Landfill)	Product or material for final deposition	8.30E-02	8.30E-02	8.30E-02	kg
Transport to Disposal	Diesel Powered Truck	1.61E+02	1.61E+02	1.61E+02	km
Removals of biogenic carbon (excluding packaging)		0.00E+00	0.00E+00	0.00E+00	kg CO_2 eq

4. Life Cycle Assessment Results

Table 14. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
EPD Type: Cradle to Installation with End of Life	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	MND	X	MND

MND – Module Not Declared

4.1. Life Cycle Impact Assessment Results

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. These six impact categories are globally deemed mature enough to be included in Type III environmental declarations.

LCIA results for fiberglass insulation and facing material are provided separately to allow for scaling of results to the appropriate R-value.

Table 15. North American Impact Assessment Results for 1 m² Unfaced MBI from Mexico City at R_{SI} = 1

NORTH AMERICA	A1 - C4	A1 - A3	A4	A5	C2	C4
GWP 100 [kg CO_2 eq] [1]	1.44E+00	1.18E+00	2.02E-03	4.58E-03	4.35E-03	2.52E-01
ADP_{fossil} [MJ, LHV]	1.14E+01	1.13E+01	2.81E-02	2.51E-03	6.04E-02	5.74E-02
ODP [kg CFC-11 eq]	8.09E-08	7.88E-08	4.86E-10	3.91E-11	1.05E-09	5.24E-10
AP [kg SO_2 eq]	2.61E-03	2.54E-03	6.15E-06	1.47E-06	1.32E-05	5.68E-05
EP [kg N eq]	8.55E-04	2.96E-04	9.04E-07	1.13E-06	1.94E-06	5.55E-04
SFP [kg O_3 eq]	5.56E-02	5.43E-02	1.38E-04	3.98E-05	2.97E-04	8.22E-04
IPCC GWP 100a (2021) [kg CO_2e] [2]	1.43E+00	1.18E+00	2.02E-03	4.57E-03	4.35E-03	2.48E-01

[GWP – Global Warming Potential, ADP_{fossil} – Abiotic Depletion Potential of Non-renewable (fossil) energy resources, ODP – Ozone Depletion Potential, AP – Acifdification Potential, EP – Eutrophication Potential, SFP – Smog Formation Potential,]

[1]The GWP 100 impacts from TRACI v2.1 (July 2012) are based on 100-year time horizon GWP factors provided by the IPCC 2007 Fourth Assessment Report (AR4).
[2]100-year time horizon GWP factors as provided by the Fifth Assessment Report (AR5) shall be used for conformance with ISO 21930, Section 7.3.

Table 16. North American Impact Assessment Results for 1 m² Facing from Mexico City

NORTH AMERICA	A1 - C4	A1 - A3	A4	A5	C2	C4
GWP 100 [kg CO_2 eq] [1]	2.01E-01	1.99E-01	5.63E-04	0.00E+00	1.17E-03	2.73E-04
ADP_{fossil} [MJ, LHV]	3.67E+00	3.64E+00	7.83E-03	0.00E+00	1.63E-02	3.69E-03
ODP [kg CFC-11 eq]	2.21E-08	2.16E-08	1.35E-10	0.00E+00	2.82E-10	6.06E-11
AP [kg SO_2 eq]	9.84E-04	9.76E-04	1.71E-06	0.00E+00	3.57E-06	2.61E-06
EP [kg N eq]	1.71E-04	1.70E-04	2.52E-07	0.00E+00	5.25E-07	2.26E-07
SFP [kg O_3 eq]	2.01E-01	1.99E-01	3.85E-05	0.00E+00	8.02E-05	7.91E-05
IPCC GWP 100a (2021) [kg CO_2e] [2]	2.01E-01	1.99E-01	3.85E-05	0.00E+00	8.02E-05	7.91E-05

[GWP – Global Warming Potential, ADP_{fossil} – Abiotic Depletion Potential of Non-renewable (fossil) energy resources, ODP – Ozone Depletion Potential, AP – Acifdification Potential, EP – Eutrophication Potential, SFP – Smog Formation Potential,]

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[2]100-year time horizon GWP factors as provided by the Fifth Assessment Report (AR5) shall be used for conformance with ISO 21930, Section 7.3.

Table 17. North American Impact Assessment Results for 1 m² Unfaced MBI from Mexicali at R_{SI} = 1

NORTH AMERICA	A1 - C4	A1 - A3	A4	A5	C2	C4
GWP 100 [kg CO_2 eq] [1]	1.56E+00	1.29E+00	4.49E-03	3.16E-03	4.35E-03	2.52E-01
ADP_{fossil} [MJ, LHV]	1.32E+01	1.30E+01	6.24E-02	1.73E-03	6.04E-02	5.74E-02
ODP [kg CFC-11 eq]	9.91E-08	9.64E-08	1.08E-09	2.69E-11	1.05E-09	5.24E-10
AP [kg SO_2 eq]	3.05E-03	2.96E-03	1.37E-05	1.01E-06	1.32E-05	5.68E-05
EP [kg N eq]	9.26E-04	3.67E-04	2.01E-06	7.76E-07	1.94E-06	5.55E-04
SFP [kg O_3 eq]	6.49E-02	6.34E-02	3.07E-04	2.74E-05	2.97E-04	8.22E-04
IPCC GWP 100a (2021) [kg CO_2e] [2]	1.55E+00	1.29E+00	4.49E-03	3.15E-03	4.35E-03	2.48E-01

[GWP – Global Warming Potential, ADP_{fossil} – Abiotic Depletion Potential of Non-renewable (fossil) energy resources, ODP – Ozone Depletion Potential, AP – Acifdification Potential, EP – Eutrophication Potential, SFP – Smog Formation Potential,]

[1]The GWP 100 impacts from TRACI v2.1 (July 2012) are based on 100-year time horizon GWP factors provided by the IPCC 2007 Fourth Assessment Report (AR4).
[2]100-year time horizon GWP factors as provided by the Fifth Assessment Report (AR5) shall be used for conformance with ISO 21930, Section 7.3.

Table 18. North American Impact Assessment Results for 1 m² Facing from Mexicali

NORTH AMERICA	A1 - C4	A1 - A3	A4	A5	C2	C4
GWP 100 [kg CO_2 eq] [1]	2.57E-01	2.53E-01	1.47E-03	0.00E+00	1.40E-03	3.26E-04
ADP_{fossil} [MJ, LHV]	4.99E+00	4.95E+00	2.04E-02	0.00E+00	1.95E-02	4.41E-03
ODP [kg CFC-11 eq]	3.14E-08	3.07E-08	3.54E-10	0.00E+00	3.37E-10	7.25E-11
AP [kg SO_2 eq]	1.19E-03	1.18E-03	4.48E-06	0.00E+00	4.27E-06	3.13E-06
EP [kg N eq]	2.14E-04	2.12E-04	6.58E-07	0.00E+00	6.28E-07	2.70E-07
SFP [kg O_3 eq]	1.87E-02	1.84E-02	1.01E-04	0.00E+00	9.59E-05	9.46E-05
IPCC GWP 100a (2021) [kg CO_2e] [2]	2.56E-01	2.53E-01	1.47E-03	0.00E+00	1.40E-03	3.26E-04

[GWP – Global Warming Potential, ADP_{fossil} – Abiotic Depletion Potential of Non-renewable (fossil) energy resources, ODP – Ozone Depletion Potential, AP – Acifdification Potential, EP – Eutrophication Potential, SFP – Smog Formation Potential,]

[1]The GWP 100 impacts from TRACI v2.1 (July 2012) are based on 100-year time horizon GWP factors provided by the IPCC 2007 Fourth Assessment Report (AR4).
[2]100-year time horizon GWP factors as provided by the Fifth Assessment Report (AR5) shall be used for conformance with ISO 21930, Section 7.3.

Table 19. North American Impact Assessment Results for 1 m² Unfaced MBI from Monterrey at R_{SI} = 1

NORTH AMERICA	A1 - C4	A1 - A3	A4	A5	C2	C4
GWP 100 [kg CO_2 eq] [1]	1.64E+00	1.38E+00	1.93E-03	4.09E-03	4.35E-03	2.52E-01
ADP_{fossil} [MJ, LHV]	1.42E+01	1.41E+01	2.68E-02	2.24E-03	6.04E-02	5.74E-02
ODP [kg CFC-11 eq]	1.13E-07	1.11E-07	4.65E-10	3.49E-11	1.05E-09	5.24E-10
AP [kg SO_2 eq]	3.06E-03	2.99E-03	5.88E-06	1.32E-06	1.32E-05	5.68E-05
EP [kg N eq]	1.00E-03	4.41E-04	8.64E-07	1.01E-06	1.94E-06	5.55E-04
SFP [kg O_3 eq]	6.14E-02	6.01E-02	1.32E-04	3.55E-05	2.97E-04	8.22E-04
IPCC GWP 100a (2021) [kg CO_2e] [2]	1.63E+00	1.37E+00	1.93E-03	4.08E-03	4.35E-03	2.48E-01

[GWP – Global Warming Potential, ADP_{fossil} – Abiotic Depletion Potential of Non-renewable (fossil) energy resources, ODP – Ozone Depletion Potential, AP – Acifdification Potential, EP – Eutrophication Potential, SFP – Smog Formation Potential,]

[1]The GWP 100 impacts from TRACI v2.1 (July 2012) are based on 100-year time horizon GWP factors provided by the IPCC 2007 Fourth Assessment Report (AR4).
[2]100-year time horizon GWP factors as provided by the Fifth Assessment Report (AR5) shall be used for conformance with ISO 21930, Section 7.3.

Table 20. North American Impact Assessment Results for 1 m² Facing from Monterrey

NORTH AMERICA	A1 - C4	A1 - A3	A4	A5	C2	C4
GWP 100 [kg CO_2 eq] [1]	2.45E-01	2.43E-01	6.45E-04	0.00E+00	1.40E-03	3.26E-04
ADP_{fossil} [MJ, LHV]	4.84E+00	4.80E+00	8.96E-03	0.00E+00	1.95E-02	4.41E-03
ODP [kg CFC-11 eq]	2.87E-08	2.81E-08	1.55E-10	0.00E+00	3.37E-10	7.25E-11
AP [kg SO_2 eq]	1.16E-03	1.15E-03	1.96E-06	0.00E+00	4.27E-06	3.13E-06
EP [kg N eq]	2.09E-04	2.08E-04	2.89E-07	0.00E+00	6.28E-07	2.70E-07
SFP [kg O_3 eq]	1.79E-02	1.77E-02	4.41E-05	0.00E+00	9.59E-05	9.46E-05
IPCC GWP 100a (2021) [kg CO_2e] [2]	7.43E-02	6.77E-02	5.50E-03	0.00E+00	8.69E-04	2.02E-04

[GWP – Global Warming Potential, ADP_{fossil} – Abiotic Depletion Potential of Non-renewable (fossil) energy resources, ODP – Ozone Depletion Potential, AP – Acifdification Potential, EP – Eutrophication Potential, SFP – Smog Formation Potential,]

[1]The GWP 100 impacts from TRACI v2.1 (July 2012) are based on 100-year time horizon GWP factors provided by the IPCC 2007 Fourth Assessment Report (AR4).
[2]100-year time horizon GWP factors as provided by the Fifth Assessment Report (AR5) shall be used for conformance with ISO 21930, Section 7.3.

4.2. Life Cycle Inventory Results

Table 21. Resource Use Indicator Results for 1 m² unfaced MBI at R_{SI} = 1 manufactured in Mexico City

RESOURCE USE	A1-A3	A4	A5	C2	C4
RPR_E [MJ, LHV]	3.40E-01	3.64E-05	4.01E-05	7.83E-05	4.90E-03
RPR_M [MJ, LHV]	7.71E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$ [MJ, LHV]	1.17E+01	2.81E-02	2.55E-03	6.05E-02	6.44E-02
$NRPR_M$ [MJ, LHV]	1.48E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	3.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m^3]	3.16E-03	5.69E-07	5.70E-06	1.22E-06	2.35E-05

[RPR_E – Renewable primary energy used as energy carrier (fuel), RPR_M – Renewable primary resources with energy content used as material, $NRPR_E$ – Non-renewable primary energy used as energy carrier (fuel), $NRPR_M$ – Non-renewable primary resources with energy content used as material, SM – Secondary materials, RSF – Renewable secondary fuels, NRSF – Non-renewable secondary fuels, RE – Recovered energy, FW – Use of net fresh water resources]

Table 22. Waste and Output Flow Indicator Results for 1 m² unfaced MBI at R_{SI} = 1 manufactured in Mexico City

OUTPUTS & WASTES	A1-A3	A4	A5	C2	C4
HWD [kg]	2.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD [kg]	3.19E-02	0.00E+00	8.13E-06	0.00E+00	4.07E-01
HLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	3.71E-03	0.00E+00	1.50E-06	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[HWD – Hazardous waste disposed, NHWD – Non-hazardous waste disposed, HLRW – High-level radioactive waste, conditioned, to final repository, ILLRW – Intermediate- and low-level radioactive waste, conditioned, to final repository, CRU – Components for re-use, R – Materials for recycling, MER – Materials for energy recovery, EE – Exported energy]

Table 23. Resource Use Indicator Results for 1 m² Facing from Mexico City

RESOURCE USE	A1-A3	A4	A5	C2	C4
RPR_E [MJ, LHV]	1.96E+00	1.01E-05	0.00E+00	2.11E-05	1.55E-05
RPR_M [MJ, LHV]	8.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$ [MJ, LHV]	3.82E+00	7.84E-03	0.00E+00	1.63E-02	3.69E-03
$NRPR_M$ [MJ, LHV]	1.07E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m^3]	2.73E-03	1.59E-07	0.00E+00	3.30E-07	7.90E-08

[RPR_E – Renewable primary energy used as energy carrier (fuel), RPR_M – Renewable primary resources with energy content used as material, $NRPR_E$ – Non-renewable primary energy used as energy carrier (fuel), $NRPR_M$ – Non-renewable primary resources with energy content used as material, SM – Secondary materials, RSF – Renewable secondary fuels, NRSF – Non-renewable secondary fuels, RE – Recovered energy, FW – Use of net fresh water resources]

Table 24. Waste and Output Flow Indicator Results for 1 m² Facing from Mexico City

OUTPUTS & WASTES	A1-A3	A4	A5	C2	C4
HWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-01
HLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[HWD – Hazardous waste disposed, NHWD – Non-hazardous waste disposed, HLRW – High-level radioactive waste, conditioned, to final repository, ILLRW – Intermediate- and low-level radioactive waste, conditioned, to final repository, CRU – Components for re-use, R – Materials for recycling, MER – Materials for energy recovery, EE – Exported energy]

Table 25. Resource Use Indicator Results for 1 m² unfaced MBI at R_{SI} = 1 in Mexicali

RESOURCE USE	A1-A3	A4	A5	C2	C4
RPR_E [MJ, LHV]	3.85E-01	8.09E-05	2.76E-05	7.83E-05	4.90E-03
RPR_M [MJ, LHV]	4.46E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$ [MJ, LHV]	1.35E+01	6.25E-02	1.76E-03	6.05E-02	6.44E-02
$NRPR_M$ [MJ, LHV]	2.93E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m^3]	3.57E-03	1.26E-06	3.93E-06	1.22E-06	2.35E-05

[RPR_E – Renewable primary energy used as energy carrier (fuel), RPR_M – Renewable primary resources with energy content used as material, $NRPR_E$ – Non-renewable primary energy used as energy carrier (fuel), $NRPR_M$ – Non-renewable primary resources with energy content used as material, SM – Secondary materials, RSF – Renewable secondary fuels, NRSF – Non-renewable secondary fuels, RE – Recovered energy, FW – Use of net fresh water resources]

Table 26. Waste and Output Flow Indicator Results for 1 m² unfaced MBI at R_{SI} = 1 in Mexicali

OUTPUTS & WASTES	A1-A3	A4	A5	C2	C4
HWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD [kg]	9.36E-01	0.00E+00	5.60E-06	0.00E+00	4.07E-01
HLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	0.00E+00	0.00E+00	1.02E-06	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[HWD – Hazardous waste disposed, NHWD – Non-hazardous waste disposed, HLRW – High-level radioactive waste, conditioned, to final repository, ILLRW – Intermediate- and low-level radioactive waste, conditioned, to final repository, CRU – Components for re-use, R – Materials for recycling, MER – Materials for energy recovery, EE – Exported energy]

Table 27. Resource Use Indicator Results for 1 m² Facing from Mexicali

RESOURCE USE	A1-A3	A4	A5	C2	C4
RPR_E [MJ, LHV]	1.96E+00	2.65E-05	0.00E+00	2.53E-05	1.85E-05
RPR_M [MJ, LHV]	8.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$ [MJ, LHV]	5.18E+00	2.05E-02	0.00E+00	1.95E-02	4.42E-03
$NRPR_M$ [MJ, LHV]	1.61E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m^3]	3.86E-03	4.14E-07	0.00E+00	3.95E-07	9.45E-08

[RPR_E – Renewable primary energy used as energy carrier (fuel), RPR_M – Renewable primary resources with energy content used as material, $NRPR_E$ – Non-renewable primary energy used as energy carrier (fuel), $NRPR_M$ – Non-renewable primary resources with energy content used as material, SM – Secondary materials, RSF – Renewable secondary fuels, NRSF – Non-renewable secondary fuels, RE – Recovered energy, FW – Use of net fresh water resources]

Table 28. Waste and Output Flow Indicator Results for 1 m² Facing from Mexicali

OUTPUTS & WASTES	A1-A3	A4	A5	C2	C4
HWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-01
HLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[HWD – Hazardous waste disposed, NHWD – Non-hazardous waste disposed, HLRW – High-level radioactive waste, conditioned, to final repository, ILLRW – Intermediate- and low-level radioactive waste, conditioned, to final repository, CRU – Components for re-use, R – Materials for recycling, MER – Materials for energy recovery, EE – Exported energy]

Table 29. Resource Use Indicator Results for 1 m² unfaced MBI at R_{SI} = 1 in Monterrey

RESOURCE USE	A1-A3	A4	A5	C2	C4
RPR_E [MJ, LHV]	4.18E-01	3.48E-05	3.58E-05	7.83E-05	4.90E-03
RPR_M [MJ, LHV]	5.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$ [MJ, LHV]	1.46E+01	2.69E-02	2.28E-03	6.05E-02	6.44E-02
$NRPR_M$ [MJ, LHV]	3.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m^3]	3.89E-03	5.44E-07	5.10E-06	1.22E-06	2.35E-05

[RPR_E – Renewable primary energy used as energy carrier (fuel), RPR_M – Renewable primary resources with energy content used as material, $NRPR_E$ – Non-renewable primary energy used as energy carrier (fuel), $NRPR_M$ – Non-renewable primary resources with energy content used as material, SM – Secondary materials, RSF – Renewable secondary fuels, NRSF – Non-renewable secondary fuels, RE – Recovered energy, FW – Use of net fresh water resources]

Table 30. Waste and Output Flow Indicator Results for 1 m² unfaced MBI at R_{SI} = 1 in Monterrey

OUTPUTS & WASTES	A1-A3	A4	A5	C2	C4
HWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD [kg]	5.86E-02	0.00E+00	7.27E-06	0.00E+00	4.07E-01
HLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	0.00E+00	0.00E+00	1.33E-06	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[HWD – Hazardous waste disposed, NHWD – Non-hazardous waste disposed, HLRW – High-level radioactive waste, conditioned, to final repository, ILLRW – Intermediate- and low-level radioactive waste, conditioned, to final repository, CRU – Components for re-use, R – Materials for recycling, MER – Materials for energy recovery, EE – Exported energy]

Table 31. Resource Use Indicator Results for 1 m² Facing from Monterrey

RESOURCE USE	A1-A3	A4	A5	C2	C4
RPR_E [MJ, LHV]	1.96E+00	2.65E-05	0.00E+00	2.53E-05	1.85E-05
RPR_M [MJ, LHV]	8.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$ [MJ, LHV]	5.03E+00	2.05E-02	0.00E+00	1.95E-02	4.42E-03
$NRPR_M$ [MJ, LHV]	1.61E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m^3]	3.86E-03	4.14E-07	0.00E+00	3.95E-07	9.45E-08

[RPR_E – Renewable primary energy used as energy carrier (fuel), RPR_M – Renewable primary resources with energy content used as material, $NRPR_E$ – Non-renewable primary energy used as energy carrier (fuel), $NRPR_M$ – Non-renewable primary resources with energy content used as material, SM – Secondary materials, RSF – Renewable secondary fuels, NRSF – Non-renewable secondary fuels, RE – Recovered energy, FW – Use of net fresh water resources]

Table 32. Waste and Output Flow Indicator Results for 1 m² Facing from Monterrey

OUTPUTS & WASTES	A1-A3	A4	A5	C2	C4
HWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-01
HLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[HWD – Hazardous waste disposed, NHWD – Non-hazardous waste disposed, HLRW – High-level radioactive waste, conditioned, to final repository, ILLRW – Intermediate- and low-level radioactive waste, conditioned, to final repository, CRU – Components for re-use, R – Materials for recycling, MER – Materials for energy recovery, EE – Exported energy]

Table 33. Carbon Emissions and Removal Indicator Results for 1 m² unfaced MBI at R_{SI} = 1

MBI (MEXICO CITY)	A1-A3	A4	A5	C2	C4
BCRP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE [kg CO_2]	7.84E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MBI (MEXICALI)	**A1-A3**	**A4**	**A5**	**C2**	**C4**
BCRP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE [kg CO_2]	5.20E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MBI (MONTERREY)	**A1-A3**	**A4**	**A5**	**C2**	**C4**
BCRP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE [kg CO_2]	9.74E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[BCRP – Biogenic Carbon Removal from Product, BCEP – Biogenic Carbon Emission from Product, BCRK – Biogenic Carbon Removal from Packaging, BCEK – Biogenic Carbon Emission from Packaging, BCEW – Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE – Calcination Carbon Emissions, CCR – Calcination Carbon Removals, CWNR – Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes]

Table 34. Carbon Emissions and Removal Indicator Results for 1 m² Facing

FACING (MEXICO CITY)	A1-A3	A4	A5	C2	C4
BCRP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FACING (MEXICALI)	**A1-A3**	**A4**	**A5**	**C2**	**C4**
BCRP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FACING (MONTERREY)	**A1-A3**	**A4**	**A5**	**C2**	**C4**
BCRP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[BCRP – Biogenic Carbon Removal from Product, BCEP – Biogenic Carbon Emission from Product, BCRK – Biogenic Carbon Removal from Packaging, BCEK – Biogenic Carbon Emission from Packaging, BCEW – Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE – Calcination Carbon Emissions, CCR – Calcination Carbon Removals, CWNR – Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes]

4.3. Calculating Impact Category Results for Products Other Than the Reference Version

The environmental impact assessment results have been calculated for a reference product for MBI

Functional Unit Scaling Factors for MBI products

Functional Unit scaling factors have been provided in Table 35 to assist in understanding the impacts for the individual products being produced at the functional unit of 1 m^2 of product at R_{SI} = 1. The scaling factor can be multiplied by the results for any of the impact categories to convert the results to the chosen product at the functional unit of 1 m^2 of product at R_{SI} = 1.

Product Scaling Factors for MBI products

The product scaling factors in Table 35 below can be multiplied by the results for any of the impact categories to convert the results from the reported functional unit to 1 m^2 of the chosen product and thickness.

Environmental impacts for products at the supplied R-values can be calculated using the same method.

Sample Functional Unit scaling calculation using MBI - Mexico City:

Scaling Factors[a]				Impact Category Data for Reference Product[b]			Impact Category Data for Facing Addon[c]			Result Calculated for R-30 MBI at R_{SI} = 1	
Product	R-value	Functional Unit Scaling Factor 1M^2 at R_{SI} = 1		North America	A1 - C4		North America	A1 - C4		North America	A1 - C4
MBI	R-30	0.99	X	GWP 100 [kg CO_2 eq]	1.44E+00	+	GWP 100 [kg CO_2 eq]	2.01E-01	=	GWP 100 [kg CO_2 eq]	1.63E+00
				ADP_{FOSSIL} [MJ, LHV]	1.14E+01		ADP_{FOSSIL} [MJ, LHV]	3.67E+00		ADP_{FOSSIL} [MJ, LHV]	1.50E+01
				ODP [kg CFC-11 eq]	8.09E-08		ODP [kg CFC-11 eq]	2.21E-08		ODP [kg CFC-11 eq]	1.02E-07
				AP [kg SO_2 eq]	2.61E-03		AP [kg SO_2 eq]	9.84E-04		AP [kg SO_2 eq]	3.57E-03
				EP [kg N eq]	8.55E-04		EP [kg N eq]	1.71E-04		EP [kg N eq]	1.02E-03
				SFP [kg O_3 eq]	5.56E-02		SFP [kg O_3 eq]	2.01E-01		SFP [kg O_3 eq]	2.56E-01

Notes:

a) **Scaling Factor** found in Table 35
b) **Environmental Impact Category Data for Reference Product** found in Table 15
c) **Environmental Impact Category Data for Facing Addon** found in Table 16

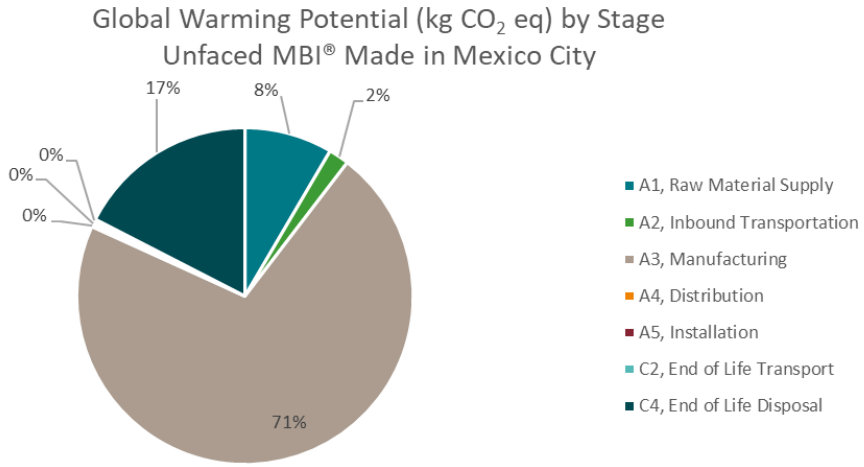
Table 35. Functional Unit and Product Scaling Factors for MBI

PRODUCT	R-VALUE	SCALING FACTOR 1 M² AT R_{SI} = 1	SCALING FACTOR FOR 1 M² AT LISTED R-VALUE
MBI	R-5	**1.06**	1.12
	R-7	**1.06**	1.47
	R-8	**1.06**	1.89
	R-9	**1.41**	2.32
	R-10	**1.00**	1.85
	R-11	**0.93**	2.17
	R-13	**0.90**	2.41
	R-15	**0.93**	2.78
	R-16	**0.88**	2.95
	R-19	**0.93**	3.71
	R-21	**0.96**	4.16
	R-22	**1.00**	4.56
	R-25	**0.99**	5.43
	R-30	**0.99**	6.64

5. LCA Interpretation

In the production of MBI, the fiberglass insulation manufacturing stage drives most of the environmental impact categories, although eutrophication potential is also highly influenced by the end of life disposal stage. Manufacturing impacts are primarily driven by energy use (electricity and natural gas) for glass melting.

The raw material supply stage accounts for the majority of the environmental impact resulting from the facing lamination process. The process of applying facing to insulation is highly manual and much less energy intensive than the manufacturing of the insulation itself.



6. Additional Environmental Information

6.1. Environment and Health During Manufacturing

Owens Corning manufacturing facilities of MBI products maintain quality management systems.

6.2. Environment and Health During Installation

This product is considered an article. 29 CFR 1910.1200(c) definition of an article is as follows: "Article" means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.

6.3. Extraordinary Effects

No extraordinary effects or environmental impacts are expected due to destruction of the product by fire, water or mechanical means.

6.4. Delayed Emissions

No delayed emissions are expected from this product.

6.5. Environmental Activities and Certifications

Certifications and Sustainable Features

- Certified by SCS Global Services to contain an average 53% recycled glass content, 31% pre-consumer and 22% post-consumer.
- Health Product Declaration

AVERAGE 53% RECYCLED CONTENT
22% POST-CONSUMER
31% PRE-CONSUMER

VERSION 2.3

6.6. Further Information

Additional information may be found at owenscorning.com.mx.

7. References

Product Category Rules for Building-Related Products and Services – Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Standard 10010, Version 3.2, UL Environment, December 12, 2018.

Product Category Rules (PCR) Guidance for Building-Related Products and Services - Part B: Building Envelope Thermal Insulation EPD Requirements, UL 10010-1 Version 2.0, UL Environment, April 10, 2018.

ISO 14025: 2006, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

ISO 14040: 2006, Environmental management – Life cycle assessment – Principles and framework

ISO 14044:2006, Environmental management – Life cycle assessment – Requirements and guidelines

ISO 14046:2013, Environmental management- Water footprint- Principles, requirements and guidelines

ISO 21930: 2017, Sustainability in building construction -- Environmental declaration of building products

EN 15804, Sustainability of construction works, Environmental product declarations, Core rules for the product category of construction products

ASTM C665-17, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

ASTM C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot-Plate Apparatus

ASTM C167, Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations

ASTM C518, Standard Test Method for Stead-State Thermal Transmission Properties by Means of the heat Flow Meter Apparatus

ASTM C991-08, Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings; Type II

ASTM E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750C

ASTM C1104/C1104M, Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation

ASTM C1338, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings

ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM C1304, Standard Test Method for Assessing the Odor Emission of Thermal Insulation Materials

UL723, Standard for Test for Surface Burning Characteristics of Building Materials

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