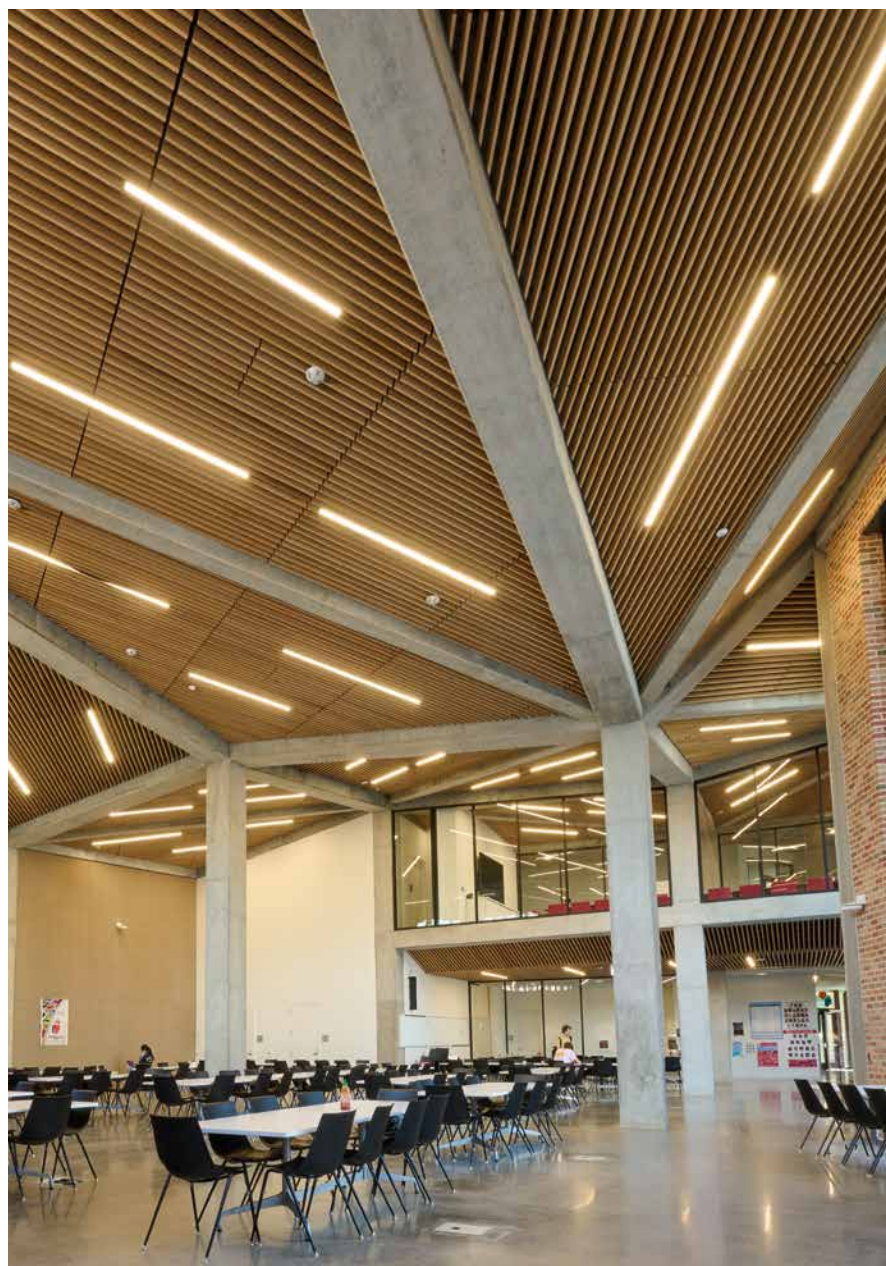


ENVIRONMENTAL PRODUCT DECLARATION

WOODWORKS® SOLID WOOD CEILING AND WALL PRODUCTS

SOLID WOOD PRODUCTS



WoodWorks® Solid Grille – Classics in Maple



CEILING & WALL SOLUTIONS

COMMITTED TO SUSTAINABILITY

Armstrong World Industries leads in delivering solutions that meet today's most stringent industry sustainability standards. We are committed to environmental responsibility in all aspects of our business, and carbon reduction is part of our 2030 Company goals and ambitions.

We were one of the first companies to create and publish the Environmental Product Declaration (EPD) in the ceiling industry. We have over a decade of experience using Life Cycle Assessment (LCA) to evaluate environmental impacts of our products starting with design, to raw materials, and through our operations. We are constantly working to optimize our operations and products to reduce their environmental impact. We believe the use of LCA and our commitment to transparency of our products' carbon footprint is critical to contributing to decarbonization of the built environment.

For more information visit
armstrongceilings.com/transparency



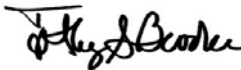
ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS SOLID WOOD PRODUCTS

According to ISO
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1. CONTENT OF THE EPD

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	ASTM International – 100 Barr Harbor Drive, West Conshohocken, PA, 19428, USA www.astm.org
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs), General Program Instructions, Version: 8.0, Revised 04/29/20
MANUFACTURER NAME AND ADDRESS	Armstrong World Industries 2500 Columbia Avenue Lancaster, PA 17603
DECLARATION NUMBER	421
DECLARED PRODUCT & DECLARED UNIT	0.093 m ² (1 ft ²) of installed ceiling and wall panel, with reference service life (RSL) of 30-years.
REFERENCE PCR AND VERSION NUMBER (Part A and B)	PCR for Building-Related Products and Services - Part A: LCA Calculation Rules and Report Requirements, UL 10010 v.3.2, December 2018. PCR Guidance for Building-Related Products and Services - Part B: Non-Metal Ceiling Panel EPD Requirements, UL Environment, v2, 04/2021
DESCRIPTION OF PRODUCT'S INTENDED APPLICATION AND USE (AS IDENTIFIED WHEN DETERMINING PRODUCT RSL)	WoodWorks Solid Wood Ceiling and Wall products including Linear Panels, Grille and Linear Tegular, Solid Grille and Open Cell
PRODUCT RSL DESCRIPTION (IF APPL.)	30 Years
MARKETS OF APPLICABILITY	North America
DATE OF ISSUE	February 15, 2023
PERIOD OF VALIDITY	5 years
EPD TYPE	Product-Specific
EPD SCOPE	Cradle-to-gate with options EPD (A1-A3, A4, A5, C1-C4), based on 30-year RSL
YEAR(S) OF REPORTED MANUFACTURER PRIMARY DATA	2021
LCA SOFTWARE & VERSION NUMBER	GaBi 10.6.2.9
LCI DATABASE(S) & VERSION NUMBER	GaBi 2022.2
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1
This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," serves as the core PCR.	
☐ INTERNAL ☒ EXTERNAL	Tim Brooke, ASTM International
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Armstrong World Industries
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria, Ph. D. Industrial Ecology Consultants 
LIMITATIONS	
Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of Non-Metal Ceiling Panel using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR. Full conformance with this 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 in results for upstream or downstream of the life cycle stages declared. ASTM certification of this EPD is not to be construed as representing aesthetics or any other attributes not specifically addressed, nor should it be construed as an ASTM endorsement of the subject of the EPD or a recommendation for its use. There is no warranty by ASTM, express or implied, as to any finding or other matter in the EPD, or as to any product covered by the EPD. The EPD holder is liable for the information and evidence on which the EPD is based.	



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2.1 DESCRIPTION OF ORGANIZATION

Armstrong World Industries, Inc. (AWI) is a leader in the design and manufacture of innovative commercial and residential ceiling, wall and suspension system solutions in the Americas. At home, at work, in healthcare facilities, classrooms, stores, or restaurants, Armstrong World Industries offers interior solutions that help to enhance comfort, save time, improve building efficiency and overall performance, and create beautiful spaces.

For more than 150 years, we have built our business on trust and integrity. It set us apart then, and it sets us apart now, along with our ability to collaborate with, and innovate for the people we're here to serve – our customers, our shareholders, our communities, and our employees.

We are committed to developing new and sustainable ceiling and wall solutions, with design and performance possibilities that make a positive difference in spaces where we live, work, learn, heal, and play.

2.2 PRODUCT DESCRIPTION

WoodWorks® Solid Wood Ceiling and Wall Products (UNSPSC Code 30161602 and CSI 09 54 26 and 07 42 00). The life cycle assessment does not include hanger wires, molding, or attachment/hold down clips.

Features:

- Includes upturns for continuous visuals and clouds with WoodWorks trim
- CleanAssure™ family of products – includes disinfectable panels, suspension systems, and trim
- Select products included in the FAST134 program – ready to ship in 4 weeks or less
- 18" x 18" Tegular infill panels now available for Metaphors® Coffers; for details, visit armstrongceilings.com/metaphors
- Shorter lead times and lower cost than custom millwork

2.2.1 Product Identification

Figure 1. WoodWorks Solid Wood



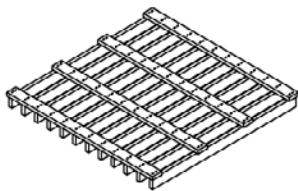
ENVIRONMENTAL PRODUCT DECLARATION



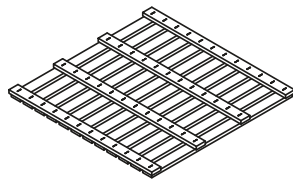
WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS SOLID WOOD PRODUCTS

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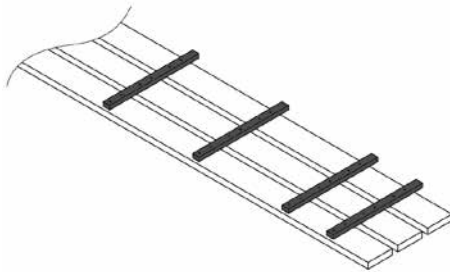
Figure 2. WW Solid Wood Products



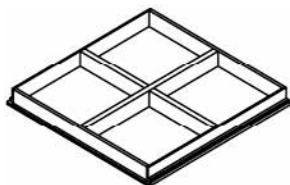
WoodWorks
Grille Tegal



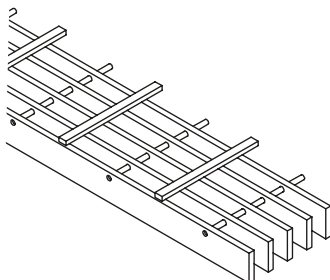
WoodWorks
Linear Tegal



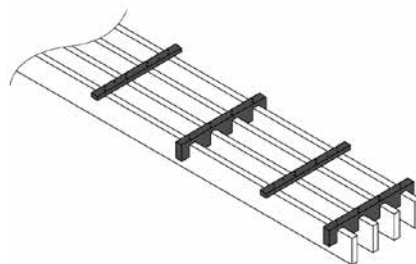
WoodWorks
Linear Solid Wood Panels



WoodWorks
Open Cell



WoodWorks
Grille - Classics



WoodWorks
Solid Grille - Forté



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2.2.2 Product Specification

These products generally fall under ASTM ASTM E1264-22, Standard Classification for Acoustical Ceiling Products, Section 5.2 designation as Type XX. This report covers all WoodWorks Solid Wood Ceiling and Wall Products.

WoodWorks Solid Wood Ceiling and Wall Products (Interior) are manufactured in Morristown, TN and Beverly, WV. Solid boards are delivered to the facility where they are cut, sanded and buffed for an even finish. The panels are then given a final protective coating that is UV cured. After packaging, the material is shipped and installed.



Figure 3. Process for manufacturing Woodworks Solid Wood Ceiling and Wall Products



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2.3 PRODUCT AVERAGE

2.3.1 Product-Specific EPD

This EPD is specific to Woodworks Solid Wood products and panels produced. A weighted average approach was applied. Inputs were developed based on 2021 production volumes and weights for Woodworks Solid wood products.

2.4 APPLICATION

The products covered by this EPD are designed to be installed in a direct-attach method or a suitable metal grid system. Panels and planks can be installed on ceiling and/or walls.

2.5 MATERIAL COMPOSITION

TABLE 1. MATERIAL COMPOSITION

The raw materials used in ceiling/wall panel manufacturing are summarized in the table below.

Material	Quantity (% by weight)
Solid wood	>99%
UV Coating Finish	<1%

2.6 TECHNICAL DATA

TABLE 2. TECHNICAL DATA

Property	Test Method	Results
Sound absorption coefficient (NRC)	ASTM C423	n/a
Interzone attenuation of open office components (AC)	ASTM E1111, ASTM E1110	n/a
Sound Transmission Class (STC)	ASTM E413, ASTM E90	n/a
Sound attenuation between rooms sharing a common ceiling plenum (CAC)	ASTM E1414, ASTM E413	n/a
Light reflectance	ASTM E1477	Varies based on color
Flame spread/smoke development	ASTM E84, ASTM E1264	Class A

2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The final EPD is available on the Armstrong website (armstrongceilings.com/epd); and is under the Finish category in the EC3 Tool (buildingtransparency.org).



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3. METHODOLOGICAL FRAMEWORK

This study provides life cycle inventory and environmental impacts relevant to Armstrong® suspended ceilings. The LCA follows an attributional approach as outlined in ISO 21930 Section 7.1.1- see also PCR Part A-6.

3.1 DECLARED UNIT

The declaration refers to the declared unit of 0.093 m² (1 ft²) of installed ceiling or wall panel, with reference service life (RSL) of 30-years.

3.2 DECLARED UNIT PROPERTIES

TABLE 3. DECLARED UNIT PROPERTIES

Woodworks Solid Wood Product	Declared Unit m ² (ft ²)	Declared Thickness cm (in)	Surface Weight kg/0.093 m ² (lb/ft ²)	Density kg/m ³ (lb/ft ³)
<i>Solid Wood Average</i>	0.093 (1)	1.905 (0.75)	1.22 (2.69)	464.45 (43.1)
<i>Grille Tegular & Linear Tegular</i>	0.093 (1)	1.905 (0.75)	0.41 (0.90)	155.32 (14.41)
<i>Linear Solid Wood Panels</i>	0.093 (1)	1.905 (0.75)	0.79 (1.75)	301.74 (28.00)
<i>Open Cell</i>	0.093 (1)	1.905 (0.75)	1.48 (3.26)	561.76 (52.13)
<i>Grille Forte & Grille Classics</i>	0.093 (1)	1.905 (0.75)	1.39 (3.06)	528.33 (49.03)

3.3 SYSTEM BOUNDARY

The scope of the study includes production, installation, and end of life. Production of capital equipment, facilities, and infrastructure required for manufacture are outside the scope of this assessment. Details of inclusions and exclusions from the system boundary are listed below.

TABLE 4. ELEMENTS INCLUDED IN THE CRADLE TO GATE WITH OPTIONS STUDY

Includes	Excludes
– Raw materials production (A1) – Inbound transport of raw materials to production facility (A2) – Manufacturing of panels (A3) – Electricity and fuel combustion (A3) – Packaging of final products (A3) – Transportation to the job site (A4) – Installation and installation waste (A5) – Deconstruction – manual, no impact (C1) – End of life, including transport (C2-C4)	– Construction of capital equipment and other infrastructure flows – Maintenance and operation of support equipment – Human labor and employee transport – Manufacture and transport of packaging materials not associated with final product – Use Phase (B1 to B7) – Benefits and loads beyond the system boundary (D)

3.4 PRODUCT-SPECIFIC CALCULATIONS FOR END-OF-LIFE PHASE (MODULES C1-C4)

At this time, there is no industry consensus for product-specific assumption behind reported scenarios for information in modules C1-C4. For this study, the end-of-life product scenario was based on the US EPA 2018 Data on Construction and Demolition Debris. Based on this data, ~74% of wood construction and demolition waste is landfilled and ~22% is incinerated. Based on this data, ~74% of wood construction and demolition waste is landfilled and ~22% is incinerated.



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3.5 REFERENCE SERVICE LIFE AND ESTIMATED BUILDING SERVICE LIFE

In accordance with the PCR, the Reference Service Life (RSL) for this study was assumed to be 30 years.

3.6 ALLOCATION

Allocation at the manufacturing plant was based on production volume. Allocation of background data (energy and materials) taken from the GaBi databases.

3.7 CUT-OFF RULES

No known flows are deliberately excluded from this EPD. The system boundary was defined based on relevance to the goal of the study. For the processes within the system boundary, all available energy and material flow data have been included in the model. In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts.

3.8 DATA SOURCES

Primary data for this study was collected from the manufacturing facility for 2021 and datasets for materials upstream from manufacturing were obtained from the GaBi database version 10.6.2.9

3.9 DATA QUALITY

The data quality ranges from good to very good. The temporal quality of the data is very good with both manufacturing specific data and GaBi background data from 2022.2. Because primary and secondary data were collected specifically to the location of manufacture when possible, geographical representativeness is considered to be good.

3.10 PERIOD UNDER REVIEW

All the primary data in the scope of this analysis was collected from manufacturing facilities during 2021.

3.11 COMPARABILITY AND BENCHMARKING

WoodWorks Solid Wood ceiling and wall panels offer a unique set of product attributes and we do not have any data on comparable non-competitive products to report.

3.12 ESTIMATES AND ASSUMPTIONS

The datasets for materials upstream from manufacturing are from the GaBi database. When inventories were not available for materials, conservative proxy datasets were chosen based on similarity of material. Additionally and consistent with the PCR, the following assumptions in Table 5 related to transport, installation, and deconstruction procedures were made.

TABLE 5. TRANSPORT, INSTALLATION, AND DECONSTRUCTION PROCEDURES

Product transport from point of manufacture to building site	Mode: Diesel-powered truck/trailer Distance: 800 km
Product transport from building site to waste processing	Mode: Diesel-powered truck/trailer Distance: 35 km
Installation & deconstruction procedures	Manual (no operational energy use)

3.13 UNITS

Units commonly used in the North American market are included in addition to the required SI units.



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4. TECHNICAL INFORMATION AND SCENARIOS

4.1 MANUFACTURING

The manufacturing process has been described in a simple flow chart in Section 2.2.3.

4.2 PACKAGING

Armstrong Solid Wood products are well packaged in a variety of wooden panels, rigid corrugate, and stretch wrap. Stacks of material are banded to wooden pallets for shipping.

4.3 TRANSPORTATION

The following information specifies any transport after the manufacturing gate. Details of type of transport, type of vehicle, distance, type, and amount of energy carrier are listed. These values are consistent with industry standard assumptions.

TABLE 6. TRANSPORT TO THE BUILDING SITE (A4)

Name	Unit	Solid Wood Average	Grille Tegular & Linear Tegular	Linear Solid Wood Panels	Open Cell	Grille Forte & Grille Classics
Liters of fuel (Diesel)	l/100km	0.00314	0.00314	0.00314	0.00314	0.00314
Transport distance	km	805	805	805	805	805
Capacity utilization (including empty runs)	%	67	67	67	67	67
Gross density of products transported	kg/m3	464.45	155.32	301.74	561.76	528.33
Capacity utilization volume factor	-	1	1	1	1	1

4.4 PRODUCT INSTALLATION

The ceiling system must be installed in accordance with Armstrong Ceilings installation guidelines. Our ceiling system installation brochure, "Installing Suspended Ceilings", is a general application overview, covering essential steps of a basic suspended ceiling installation. You can reference this document at armstrongceilings.com/installationinstructions



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TABLE 7. INSTALLATION INTO THE BUILDING (A5)

Name	<i>Solid Wood Average</i>	<i>Grille Tegular & Linear Tegular</i>	<i>Linear Solid Wood Panels</i>	<i>Open Cell</i>	<i>Grille Classics & Grille Forté</i>	Unit %
Ancillary materials	0	0	0	0	0	kg
Net freshwater consumption specified by water source and fate (X m3 river water evaporated, X m3 city water disposed to sewer)	0	0	0	0	0	m ³
Other resources	0	0	0	0	0	kg
Electricity consumption	0	0	0	0	0	kWh
Other energy carriers	0	0	0	0	0	MJ
Product loss per declared unit	0.086	0.029	0.056	0.103	0.097	kg
Waste materials at the construction site before waste processing, generated by product installation	0	0	0	0	0	kg
Output materials resulting from on-site waste processing	0	0	0	0	0	kg
Mass of packaging waste specified by type						
Plastic	0.003	0.003	0.003	0.003	0.003	kg
Metal	0.056	0.046	0.046	0.046	0.062	kg
Cardboard	0.922	-	-	-	1.447	kg
Wood	1.439	1.034	1.034	1.034	1.670	kg
Biogenic carbon contained in packaging	0.656	0.695	0.695	0.695	0.850	kg CO ₂
Direct emissions to ambient air, soil and water	-	-	-	-	-	kg
VOC emissions	Negligible	Negligible	Negligible	Negligible	Negligible	µg/m ³

4.5 USE

A product's RSL depends on the product properties and reference in-use conditions. The default RSL assumed in this PCR is 30 years for both ceiling and wall products.

4.6 DISPOSAL

End of Life

The end-of-life phase for the ceiling and wall panels was included in the study. End-of-life impacts include landfill disposal of ceiling/



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TABLE 8. END OF LIFE (C1-C4)

Name		<i>Solid Wood Average</i>	<i>Grille Tegular & Linear Tegular</i>	<i>Linear Solid Wood Panels</i>	<i>Open Cell</i>	<i>Grille Forté & Grille Classics</i>	Unit
Collection process (specified by type)	Collected separately	0	0	0	0	0	kg
	Collected with mixed construction waste	0	0	0	0	0	kg
Recovery (specified by type)	Reuse	0	0	0	0	0	kg
	Recycling	0	0	0	0	0	kg
	Incineration	0	0	0	0	0	kg
	Incineration with energy recovery	0	0	0	0	0	kg
	Energy conversion (specify efficiency rate)	0	0	0	0	0	%
Disposal (specified by type)	Product or material for final disposal	0.086	0.029	0.056	0.103	0.097	kg
Removals of biogenic carbon (excluding packaging)		0.050	0.020	0.040	0.072	0.067	kg CO ₂

4.7 REUSE PHASE

TABLE 9. REUSE, RECOVERY, AND/OR RECYCLING POTENTIALS (D), RELEVANT SCENARIO INFORMATION

Name	Value	Unit
Net energy benefit from energy recovery from waste treatment declared as exported energy in C3 (R>0.6)	0	MJ
Net energy benefit from thermal energy due to treatment of waste declared as exported energy in C4 (R<0.6)	0	MJ
Net energy benefit from material flow declared in C3 for energy recovery	0	MJ
Process and conversion efficiencies	–	
Further assumptions for scenario development	–	



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5. ENVIRONMENTAL INDICATORS DERIVED FROM LCA

5.1 LCA RESULTS

The Life Cycle Assessment (LCA) was performed according to ISO 14040 guidelines and follows the specific PCR instructions. The cradle-to-gate with options LCA consists of raw material production, transport of raw materials to production facility prior to processing, manufacturing of ceiling and wall panels, packaging; transportation to job site and installation, and end of life.

TABLE 10. DESCRIPTION OF THE SYSTEM BOUNDARY MODULES (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

EPD Type	Production			Construction		Use							End Of Life				Benefits And Loads Beyond 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 to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Deconstruction	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
						B6 Operational Energy Use of Building Integrated System During Product Use											
						B7 Operational Water Use of Building Integrated System During Product Use											
Cradle to Gate with Options	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND

5.2 LCA RESULTS FROM LCIA

Life cycle impacts reported below are based on TRACI 2.1 methodology. Results are provided in reference to the declared unit. For the other impact categories, results are presented in the tables below using the ISO 21930 standard and for the declared unit. Because products include biobased content, they store or sequester carbon. Table 11 includes both Global Warming Potential (GWP) excluding biogenic and GWP including biogenic carbon. 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. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.



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TABLE 11. TRACI 2.1 IMPACT ASSESSMENT FOR 0.093 m² (1 ft²) OF WOODWORKS SOLID*

Solid Wood Average								
Parameter	Unit	A1	A2	A3	A4	A5	C2	C4
GWP, excluding biogenic	kg CO2 eq.	0.529	0.028	2.653	0.080	0.442	0.011	0.292
GWP, including biogenic	kg CO2 eq.	-2.365	0.028	2.920	0.081	0.690	0.011	0.471
ODP	kg CFC 11 eq.	5.18E-10	7.38E-17	1.51E-14	1.34E-16	1.79E-15	2.16E-19	1.13E-15
AP	kg SO2 eq.	7.24E-03	1.15E-04	7.21E-03	3.57E-04	4.22E-03	3.12E-05	2.54E-03
EP	kg N eq.	5.46E-04	1.27E-05	1.81E-04	3.11E-05	2.18E-03	2.01E-06	1.29E-03
SFP	kg O3 eq.	0.131	0.003	0.038	0.008	0.010	0.001	0.007
FFD	MJ Surplus	1.673	0.078	3.060	0.132	0.106	0.000	0.072
Grille Tegular & Linear Tegular								
Parameter	Unit	A1	A2	A3	A4	A5	C2	C4
GWP, excluding biogenic	kg CO2 eq.	0.811	0.010	6.386	0.082	0.260	0.004	0.112
GWP, including biogenic	kg CO2 eq.	-1.456	0.010	6.546	0.082	0.418	0.004	0.178
ODP	kg CFC 11 eq.	3.95E-10	2.29E-17	3.05E-14	1.49E-16	1.02E-15	8.07E-20	4.28E-16
AP	kg SO2 eq.	5.26E-03	3.72E-05	3.68E-02	3.75E-04	2.29E-03	1.17E-05	9.56E-04
EP	kg N eq.	6.91E-04	3.98E-06	5.14E-04	3.32E-05	1.17E-03	7.53E-07	4.85E-04
SFP	kg O3 eq.	0.102	0.001	0.114	0.009	0.006	0.000	0.003
FFD	MJ Surplus	1.762	0.024	7.518	0.146	0.060	0.000	0.031
Linear Solid Wood Panels								
Parameter	Unit	A1	A2	A3	A4	A5	C2	C4
GWP, excluding biogenic	kg CO2 eq.	0.755	0.015	6.389	0.086	0.371	0.008	0.214
GWP, including biogenic	kg CO2 eq.	-2.101	0.015	6.701	0.086	0.585	0.008	0.344
ODP	kg CFC 11 eq.	3.9726E-10	4.43994E-17	3.06101E-14	1.48566E-16	1.48347E-15	1.57001E-19	8.27164E-16
AP	kg SO2 eq.	6.59E-03	5.71E-05	3.68E-02	3.86E-04	3.44E-03	2.27E-05	1.85E-03
EP	kg N eq.	7.34E-04	6.75E-06	5.15E-04	3.38E-05	1.77E-03	1.46E-06	9.42E-04
SFP	kg O3 eq.	0.128	0.001	0.115	0.009	0.009	0.001	0.005
FFD	MJ Surplus	1.920	0.046	7.522	0.146	0.088	0.000	0.054

*Modules C1 and C3 are null.



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TABLE 11. TRACI 2.1 IMPACT ASSESSMENT FOR 0.093 m² (1 ft²) OF WOODWORKS SOLID* (CONT.)

<i>Open Cell</i>								
Parameter	Unit	A1	A2	A3	A4	A5	C2	C4
GWP, excluding biogenic	kg CO2 eq.	0.662	0.023	6.393	0.091	0.556	0.014	0.384
GWP, including biogenic	kg CO2 eq.	-3.175	0.022	6.959	0.092	0.864	0.014	0.619
ODP	kg CFC 11 eq.	4.01085E-10	8.01672E-17	3.07706E-14	1.48566E-16	2.25809E-15	2.84162E-19	1.49189E-15
AP	kg SO2 eq.	8.81E-03	9.03E-05	3.69E-02	4.02E-04	5.36E-03	4.11E-05	3.34E-03
EP	kg N eq.	8.06E-04	1.14E-05	5.18E-04	3.49E-05	2.78E-03	2.65E-06	1.71E-03
SFP	kg O3 eq.	0.171	0.002	0.115	0.009	0.013	0.001	0.009
FFD	MJ Surplus	2.184	0.083	7.529	0.146	0.134	0.000	0.093
<i>Grille Forté & Grille Classics</i>								
Parameter	Unit	A1	A2	A3	A4	A5	C2	C4
GWP, excluding biogenic	kg CO2 eq.	0.726	0.044	1.302	0.106	0.585	0.014	0.388
GWP, including biogenic	kg CO2 eq.	-3.165	0.044	1.658	0.106	0.913	0.015	0.625
ODP	kg CFC 11 eq.	5.96015E-10	1.10598E-16	5.87299E-15	1.75686E-16	2.36901E-15	2.86524E-19	1.50542E-15
AP	kg SO2 eq.	9.38E-03	1.84E-04	5.91E-03	4.69E-04	5.59E-03	4.14E-05	3.37E-03
EP	kg N eq.	7.85E-04	1.99E-05	9.31E-05	4.09E-05	2.89E-03	2.67E-06	1.72E-03
SFP	kg O3 eq.	0.175	0.004	0.019	0.011	0.013	0.001	0.009
FFD	MJ Surplus	2.229	0.117	0.954	0.173	0.141	0.000	0.095

*Modules C1 and C3 are null.



ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS SOLID WOOD PRODUCTS

According to ISO
14025 AND
ISO 21930

TABLE 12. LCA RESULTS - RESOURCE USE FOR 0.093 m² (1 ft²) OF WOODWORKS

Solid Wood Average									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
RPR _e	Renewable primary resources used as energy carrier (fuel)	MJ, LHV	18.281	0.023	1.904	0.039	0.079	7.92E-05	5.08E-02
RPR _m	Renewable primary resources with energy content used as material	MJ, LHV	18.205	n/a	0.00E+00	n/a	1.274	0.00E+00	0.00E+00
NRPRE	Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	17.026	0.586	37.011	0.995	0.848	0.002	0.576
NRPRM	Non-renewable primary resources with energy content used as material	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Secondary materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Renewable secondary fuels	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRDF	Non-renewable secondary fuels	m ³	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Recovered Energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m ³	6.04E-03	9.00E-05	8.03E-03	1.39E-04	3.97E-04	3.37E-07	3.96E-04
Grille Tegular & Linear Tegular									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
RPR _e	Renewable primary resources used as energy carrier (fuel)	MJ, LHV	23.293	0.007	5.173	0.043	0.044	2.96E-05	2.03E-02
RPR _m	Renewable primary resources with energy content used as material	MJ, LHV	6.083	n/a	0.00E+00	n/a	0.426	0.00E+00	0.00E+00
NRPRE	Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	16.143	0.179	97.237	1.106	0.482	0.001	0.247
NRPRM	Non-renewable primary resources with energy content used as material	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Secondary materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Renewable secondary fuels	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRDF	Non-renewable secondary fuels	m ³	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Recovered Energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m ³	9.30E-03	2.69E-05	1.54E-02	1.55E-04	3.37E-04	1.26E-07	1.53E-04

*Modules C1 and C3 are null.



ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS SOLID WOOD PRODUCTS

According to ISO
14025 AND
ISO 21930

TABLE 12. LCA RESULTS - RESOURCE USE FOR 0.093 m² (1 ft²) OF WOODWORKS (CONT.)

<i>Linear Solid Wood Panels</i>									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
RPR _e	Renewable primary resources used as energy carrier (fuel)	MJ, LHV	23.293	0.014	5.176	0.043	0.065	5.77E-05	3.77E-02
RPR _m	Renewable primary resources with energy content used as material	MJ, LHV	12.165	n/a	8.52E-01	n/a	0.000	0.00E+00	0.00E+00
NRPRE	Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	18.319	0.347	97.277	1.106	0.703	0.001	0.436
NRPRM	Non-renewable primary resources with energy content used as material	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Secondary materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Renewable secondary fuels	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRDF	Non-renewable secondary fuels	m ³	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Recovered Energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m ³	9.30E-03	5.19E-05	1.57E-02	1.55E-04	3.87E-04	2.45E-07	2.91E-04
<i>Open Cell</i>									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
RPR _e	Renewable primary resources used as energy carrier (fuel)	MJ, LHV	23.293	0.014	5.176	0.043	0.065	5.77E-05	3.77E-02
RPR _m	Renewable primary resources with energy content used as material	MJ, LHV	12.165	n/a	8.52E-01	n/a	0.000	0.00E+00	0.00E+00
NRPRE	Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	18.319	0.347	97.277	1.106	0.703	0.001	0.436
NRPRM	Non-renewable primary resources with energy content used as material	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Secondary materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Renewable secondary fuels	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRDF	Non-renewable secondary fuels	m ³	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Recovered Energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m ³	9.30E-03	5.19E-05	1.57E-02	1.55E-04	3.87E-04	2.45E-07	2.91E-04

*Modules C1 and C3 are null.



ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS SOLID WOOD PRODUCTS

According to ISO
14025 AND
ISO 21930

TABLE 12. LCA RESULTS - RESOURCE USE FOR 0.093 m² (1 ft²) OF WOODWORKS (CONT.)

<i>Grille Forté & Grille Classics</i>									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
RPR _e	Renewable primary resources used as energy carrier (fuel)	MJ, LHV	25.232	0.035	0.913	0.051	0.105	1.05E-04	6.75E-02
RPR _m	Renewable primary resources with energy content used as material	MJ, LHV	20.709	n/a	1.45E+00	n/a	0.000	0.00E+00	0.00E+00
NRPRE	Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	22.564	0.886	14.584	1.308	1.123	4.47E-07	0.001
NRPRM	Non-renewable primary resources with energy content used as material	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Secondary materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Renewable secondary fuels	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRDF	Non-renewable secondary fuels	m ³	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Recovered Energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m ³	9.12E-03	1.38E-04	3.01E-03	1.83E-04	5.24E-04	4.47E-07	5.26E-04

*Modules C1 and C3 are null.

TABLE 13. LCA RESULTS: OUTPUT FLOWS AND WASTE CATEGORIES FOR 0.093 m² (1 ft²) OF WOODWORKS*

<i>Solid Wood Average</i>									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
HWD	Hazardous waste disposed	kg	1.31E-07	2.43E-12	1.55E-09	4.13E-12	3.28E-11	7.92E-15	2.14E-11
NHWD	NHWD Non-hazardous waste disposed	kg	0.02	0.00	0.01	0.00	1.09	0.00	0.65
HLRW	HLRW High-level radioactive waste, conditioned, to final repository	kg	1.41E-07	1.82E-09	3.60E-06	3.27E-09	9.55E-09	5.38E-12	6.87E-09
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	1.75E-04	1.53E-06	3.01E-03	2.75E-06	8.32E-06	4.54E-09	5.95E-06
CRU	Components for re-use	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MR	Materials for recycling	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	Materials for energy recovery	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EE	Recovered energy exported from the product system	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*Modules C1 and C3 are null.



ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS SOLID WOOD PRODUCTS

According to ISO
14025 AND
ISO 21930

TABLE 13. LCA RESULTS: OUTPUT FLOWS AND WASTE CATEGORIES FOR 0.093 m² (1 ft²) OF WOODWORKS* (CONT.)

<i>Grille Tegular & Linear Tegular</i>									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
HWD	Hazardous waste disposed	kg	2.26E-07	7.43E-13	3.74E-09	4.60E-12	1.91E-11	2.96E-15	8.15E-12
NHWD	NHWD Non-hazardous waste disposed	kg	0.026	0.000	0.022	0.000	0.594	0.000	0.244
HLRW	HLRW High-level radioactive waste, conditioned, to final repository	kg	2.31E-07	5.64E-10	9.69E-06	3.63E-09	6.00E-09	2.01E-12	2.68E-09
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	2.91E-04	4.75E-07	8.10E-03	3.06E-06	5.21E-06	1.70E-09	2.32E-06
CRU	Components for re-use	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MR	Materials for recycling	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	Materials for energy recovery	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EE	Recovered energy exported from the product system	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Linear Solid Wood Panels</i>									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
HWD	Hazardous waste disposed	2.26E-07	1.44E-12	3.74E-09	4.60E-12	2.74E-11	2.30E-07	2.26E-07	2.14E-11
NHWD	NHWD Non-hazardous waste disposed	0.026	0.000	0.024	0.000	0.890	0.000	0.475	0.65
HLRW	HLRW High-level radioactive waste, conditioned, to final repository	2.31E-07	1.09E-09	9.69E-06	3.63E-09	8.21E-09	3.92E-12	5.06E-09	6.87E-09
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	2.91E-04	9.20E-07	8.10E-03	3.06E-06	7.14E-06	3.30E-09	4.38E-06	5.95E-06
CRU	Components for re-use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MR	Materials for recycling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	Materials for energy recovery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EE	Recovered energy exported from the product system	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*Modules C1 and C3 are null.



ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS SOLID WOOD PRODUCTS

According to ISO
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ISO 21930

TABLE 13. LCA RESULTS: OUTPUT FLOWS AND WASTE CATEGORIES FOR 0.093 m² (1 ft²) OF WOODWORKS* (CONT.)

Open Cell									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
HWD	Hazardous waste disposed	kg	2.26E-07	2.59E-12	3.75E-09	4.60E-12	4.12E-11	2.30E-07	2.26E-07
NHWD	NHWD Non-hazardous waste disposed	kg	2.63E-02	5.50E-05	2.63E-02	9.50E-05	1.38E+00	2.35E-07	8.60E-01
HLRW	HLRW High-level radioactive waste, conditioned, to final repository	kg	2.31E-07	1.97E-09	9.70E-06	3.63E-09	1.19E-08	1.04E-14	2.82E-11
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	2.91E-04	1.66E-06	8.10E-03	3.06E-06	1.04E-05	9.81E-06	3.62E-02
CRU	Components for re-use	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MR	Materials for recycling	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	Materials for energy recovery	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EE	Recovered energy exported from the product system	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grille Forté & Grille Classics									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
HWD	Hazardous waste disposed	2.04E-07	3.67E-12	4.72E-10	5.44E-12	4.34E-11	1.05E-14	2.85E-11	2.14E-11
NHWD	NHWD Non-hazardous waste disposed	2.39E-02	7.88E-05	6.82E-03	1.12E-04	1.44E+00	2.37E-07	8.67E-01	0.65
HLRW	HLRW High-level radioactive waste, conditioned, to final repository	2.10E-07	2.73E-09	1.71E-06	4.30E-09	1.26E-08	7.15E-12	9.12E-09	6.87E-09
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	2.64E-04	2.30E-06	1.43E-03	3.62E-06	1.10E-05	6.03E-09	7.91E-06	5.95E-06
CRU	Components for re-use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MR	Materials for recycling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	Materials for energy recovery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EE	Recovered energy exported from the product system	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*Modules C1 and C3 are null.

TABLE 14. CARBON EMISSIONS AND REMOVALS DESCRIPTION FOR 0.093 M² (1 ft²) OF WOODWORKS*

Parameter	Description	Unit	Solid Wood Average	Grille Tegular & Linear Tegular	Linear Solid Wood Panels	Open Cell	Grille Forté & Grille Classics
BCRP	Biogenic Carbon Removal from Product	kg CO ₂	-2.22E+00	-0.871034063	-1.742068127	-3.193791566	-2.961515816
BCEP	Biogenic Carbon Emission from Product	kg CO ₂	7.19E-01	0.282426889	0.564853778	1.03556526	0.960251423
BCRK	Biogenic Carbon Removal from Packaging	kg CO ₂	-1.85E+00	-2.143970919	-2.143970919	-2.143970919	-2.468526505
BCEK	Biogenic Carbon Emission from Packaging	kg CO ₂	6.56E-01	0.695271171	0.695271171	0.695271171	0.84993247



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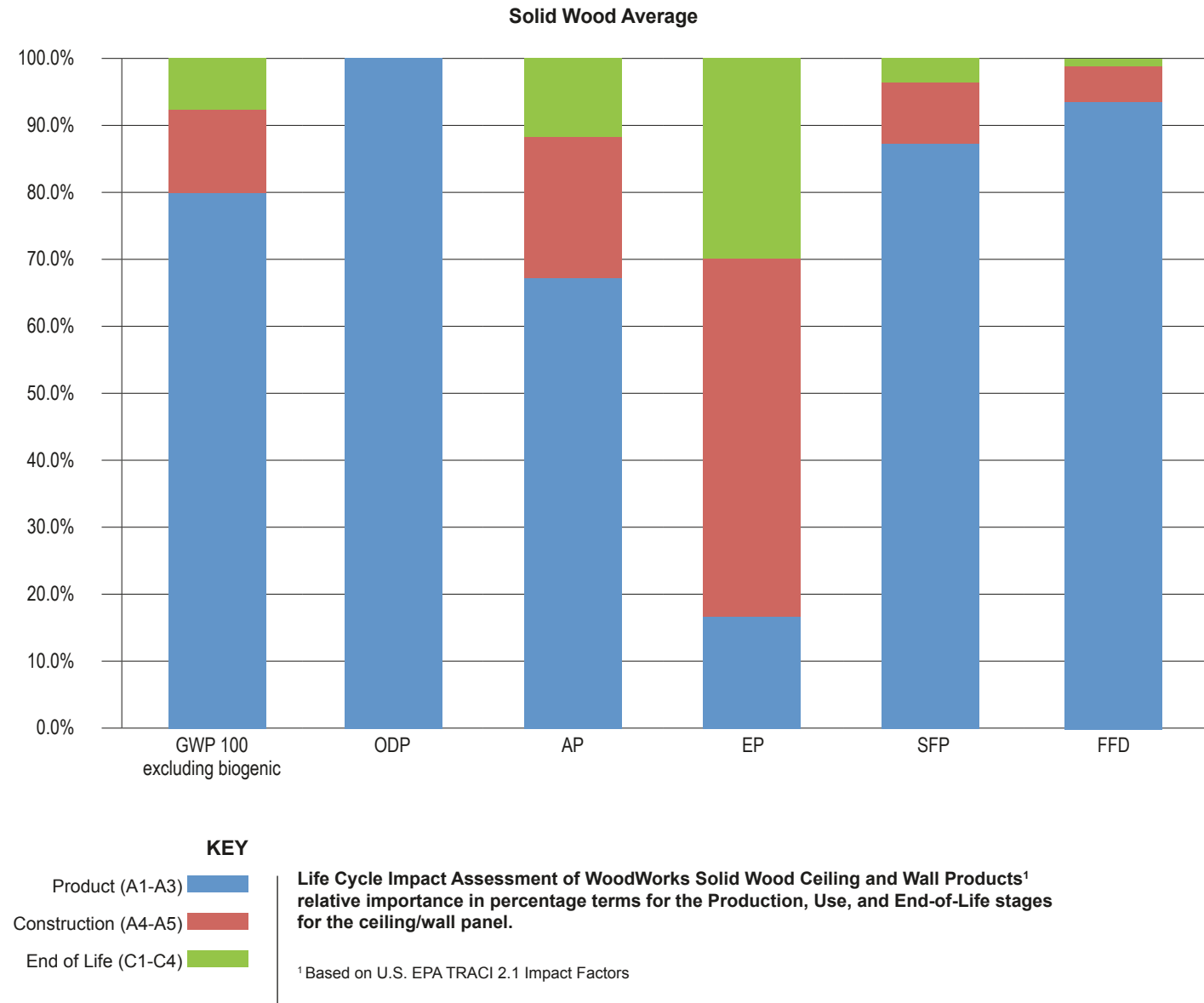


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According to ISO
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6. LCA: INTERPRETATION

Based on the LCA Model of the ceiling/wall life cycle covered in this study, it was concluded that the ceiling and wall panel manufacturing process and raw materials in the ceiling/wall panel have the greatest impact on “carbon footprint” as represented by Global Warming Potential [GWP].

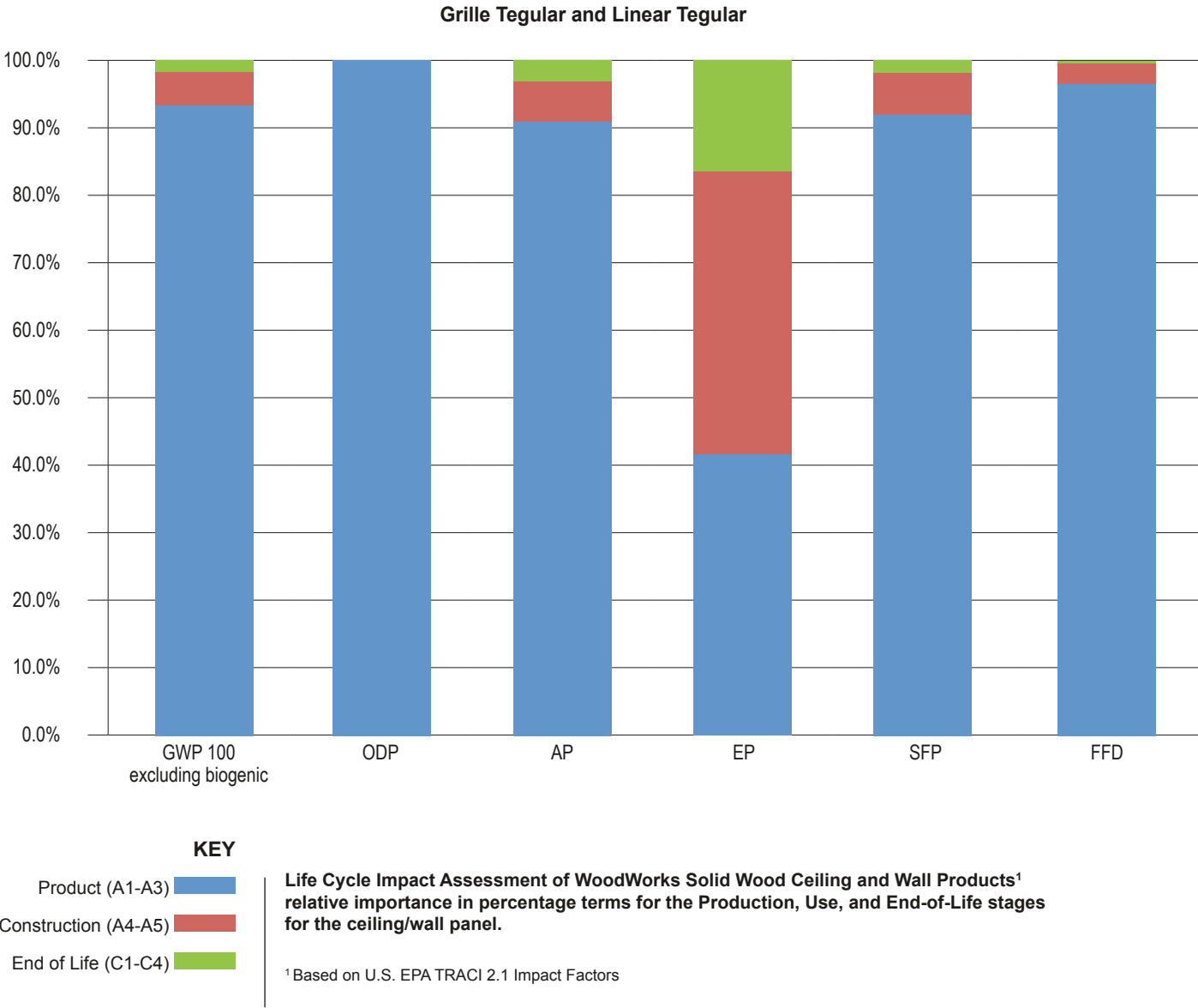


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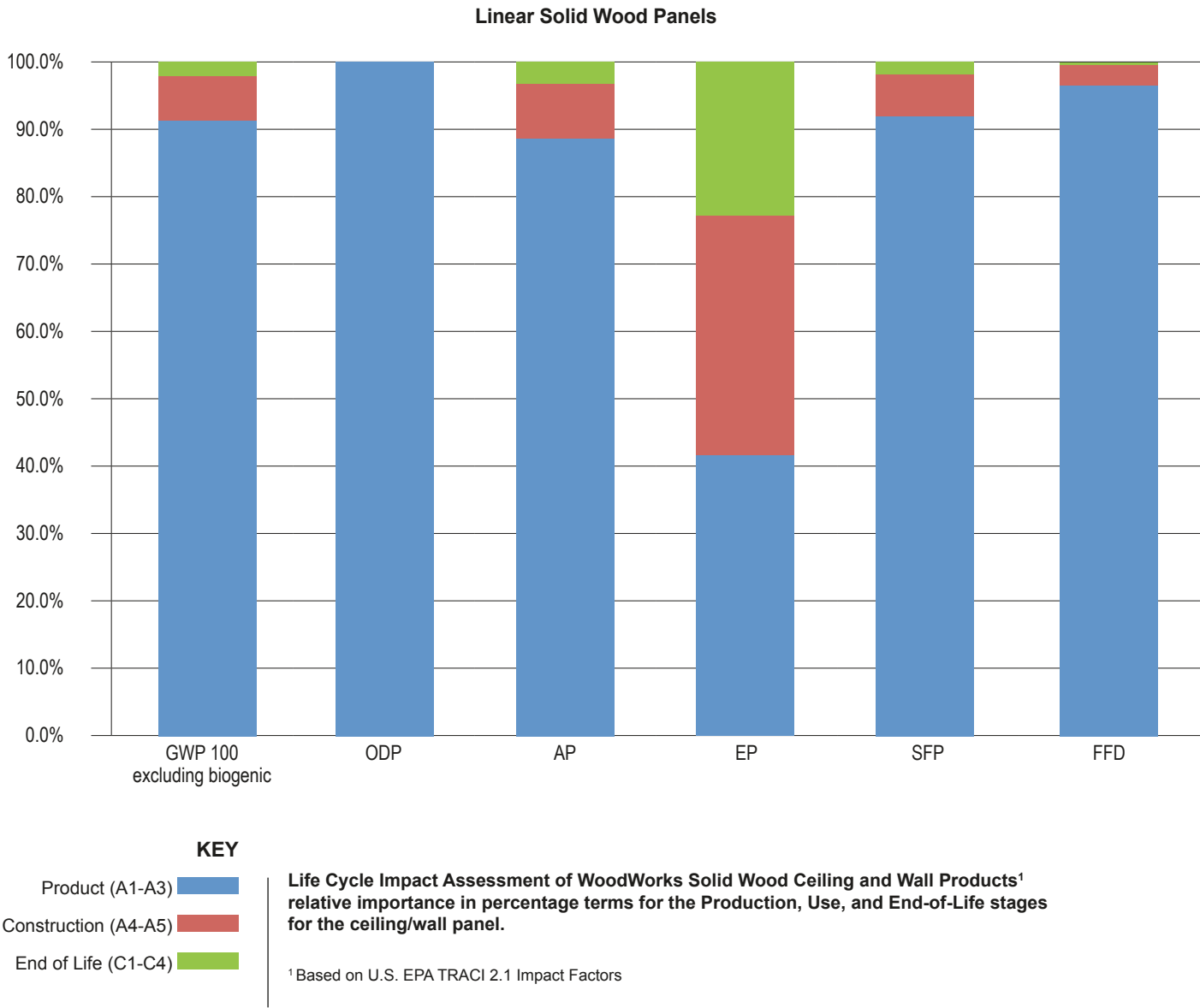


ENVIRONMENTAL PRODUCT DECLARATION



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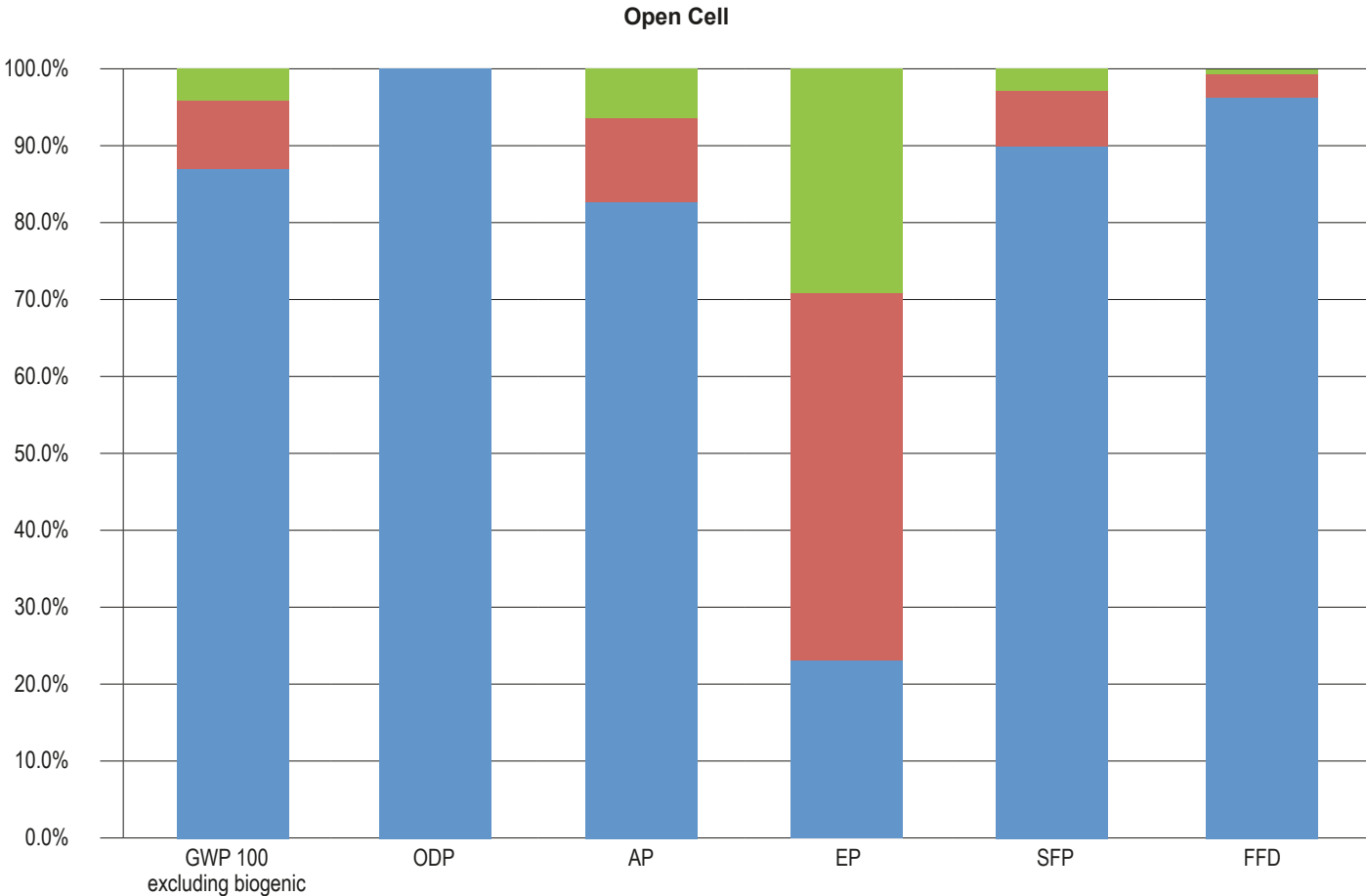


ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS
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KEY

- Product (A1-A3)
- Construction (A4-A5)
- End of Life (C1-C4)

Life Cycle Impact Assessment of WoodWorks Solid Wood Ceiling and Wall Products¹
relative importance in percentage terms for the Production, Use, and End-of-Life stages
for the ceiling/wall panel.

¹ Based on U.S. EPA TRACI 2.1 Impact Factors



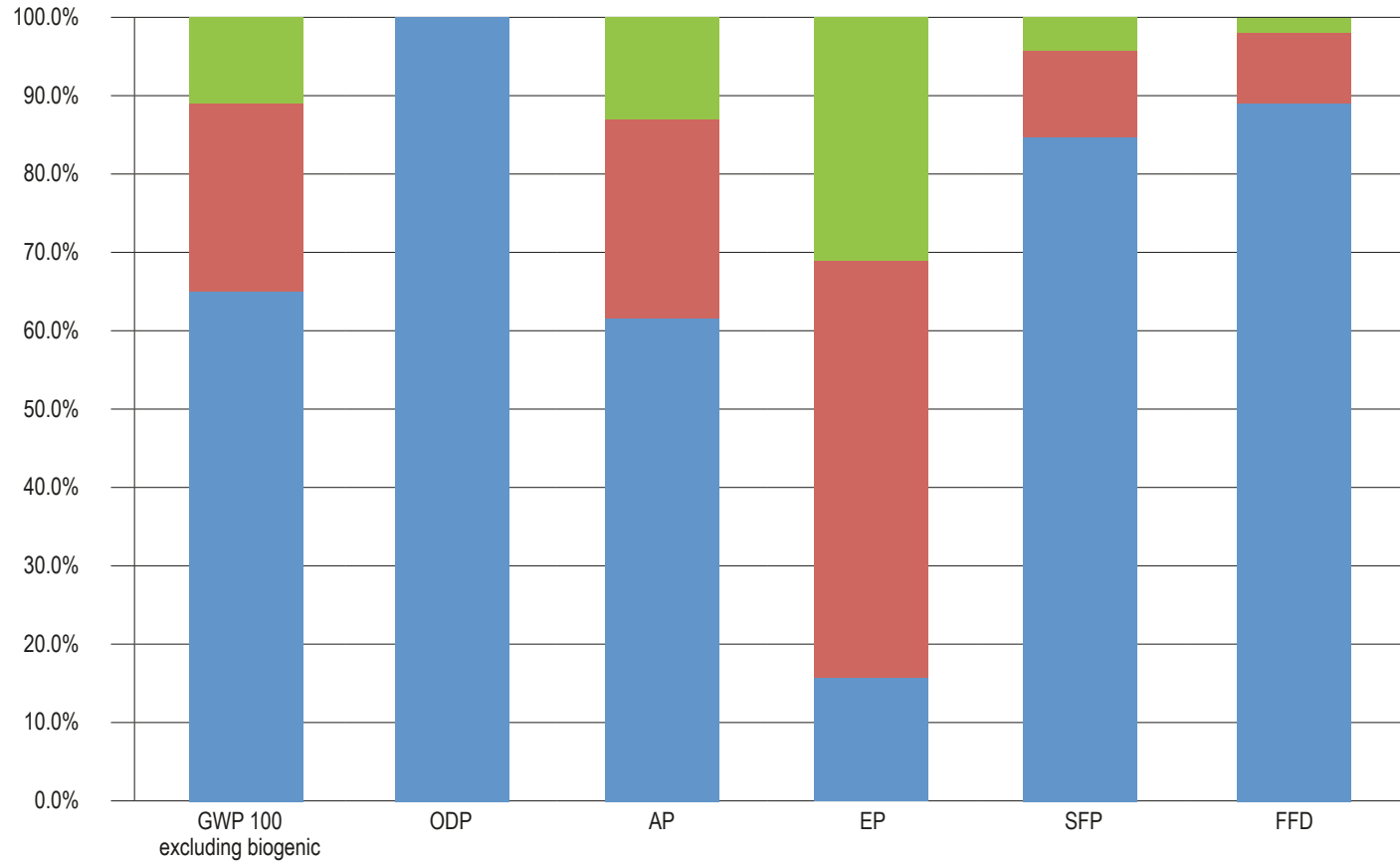
ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS
SOLID WOOD PRODUCTS

According to ISO
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ISO 21930

Grille Forté & Grille Classics



KEY

- Product (A1-A3)
- Construction (A4-A5)
- End of Life (C1-C4)

Life Cycle Impact Assessment of WoodWorks Solid Wood Ceiling and Wall Products¹
relative importance in percentage terms for the Production, Use, and End-of-Life stages
for the ceiling/wall panel.

¹ Based on U.S. EPA TRACI 2.1 Impact Factors



ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS SOLID WOOD PRODUCTS

According to ISO
14025 AND
ISO 21930

7. ADDITIONAL ENVIRONMENTAL INFORMATION

7.1 ENVIRONMENT AND HEALTH DURING MANUFACTURING

Armstrong World Industries has a comprehensive environmental, health, and safety management program. Risk reduction begins in the product design process. All products go through a safety, health, and environmental review prior to sale. Armstrong also has a long-standing commitment to the safety and health of all our employees.

Armstrong World Industries is equally committed to reducing our environmental impact. As with safety goals, each manufacturing facility has environmental initiatives focused on responsible use of energy and water, and on waste reduction.

7.2 ENVIRONMENT AND HEALTH DURING INSTALLATION

All recommendations shall be utilized as indicated by SDS and installation guidelines. Specific product SDS and installation instructions can be downloaded at: armstrongceilings.com/content/dam/armstrongceilings/commercial/north-america/sds/woodworks-sds.pdf

7.3 QUALITY

Armstrong World Industries has a robust internal Quality Assurance process that is based on industry-accepted best practices and is led by a team of quality professionals who have been certified by the American Society for Quality. The process involves several hundred different measures made throughout the manufacturing processes. The Armstrong Ceilings acoustical laboratory is ISO 17025 certified and is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

7.4 ENVIRONMENTAL ACTIVITIES AND CERTIFICATIONS

All environmental certifications can be found at: Armstrongceilings.com

Technical Downloads & Resources: armstrongceilings.com/commercial/en/performance/sustainable-building-design/sustain-ceiling-systems.html

7.5 FURTHER INFORMATION

Additional Information can be found at: armstrongceilings.com

8. PROJECT REPORT AND SUPPORTING DOCUMENTATION

This study provides life cycle inventory and environmental impacts relevant to Armstrong® suspended ceilings. This report is intended to fulfill the reporting requirements in Section 5 of ISO 14044 and Product Category Rules Guidance for Building-Related Products and Services UL® Environments (2021) Part B: Non-Metal Ceiling Panel EPD Requirements.



ENVIRONMENTAL PRODUCT DECLARATION



WOODWORKS SOLID WOOD CEILING AND WALL PRODUCTS SOLID WOOD PRODUCTS

According to ISO
14025 AND
ISO 21930

9. REFERENCES

ASTM International General Program instructions, v8.0, April 29, 2020.

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

ISO 14040 -Environmental management – Life Cycle Assessment – Principles and framework, Amd 1: 2020.

ISO 14044:2006/Amd1:2017/Environmental management – Life cycle assessment – Requirements and guidelines

ISO 21930:2017 – Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services

Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers version 1.2, January 2017.

UL Product Category Rules for Building-Related Products and Services Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, UL 10010, v3.2 December, 2018.

UL Product Category Rules for Building-Related Products and Services Part B: Non-Metal Ceiling Panel EPD Requirements, UL 10010-26, v2.0, 2021.

US EPA, Construction and Demolition Debris Management in the United States, March 2020

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