

# Environmental Product Declaration



In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

## Warm Edge Spacer SP12, SP13, SP14

From

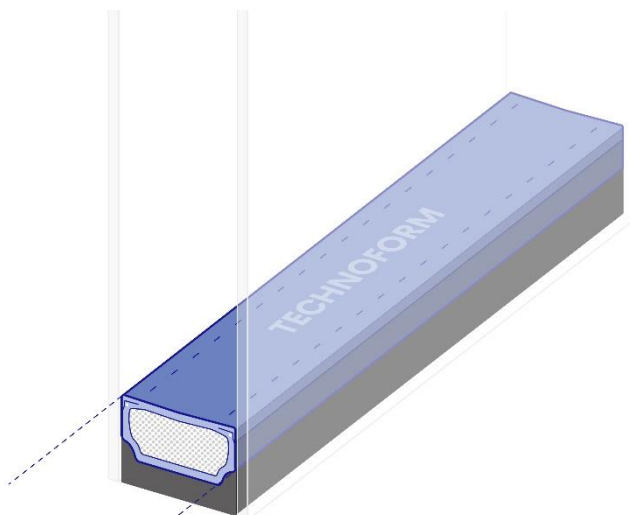
**Technoform Edge Bond Solutions Singapore Pte Ltd**

# TECHNOFORM

Programme: The International EPD® System, [www.environdec.com](http://www.environdec.com)  
 Programme operator: EPD International AB  
 EPD registration number: S-P-10425  
 Publication date: 2023-12-11  
 Valid until: 2028-12-11

*An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at [www.environdec.com](http://www.environdec.com)*

*EPD of multiple products, based on a representative product.*



Width	Technoform Warm Edge Spacer covered in this EPD		
	SP12	SP13	SP14
8mm	✓		
9mm	✓		
10mm		✓	✓
12mm		✓	✓
14mm		✓	✓
15mm		✓	✓
16mm		✓	✓
18mm		✓	✓
20mm		✓	✓

## General information

### Programme information

<b>Programme:</b>	The International EPD® System
<b>Address:</b>	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
<b>Website:</b>	<a href="http://www.environdec.com">www.environdec.com</a>
<b>E-mail:</b>	<a href="mailto:info@environdec.com">info@environdec.com</a>

<b>Accountabilities for PCR, LCA and independent, third-party verification</b>
<b>Product Category Rules (PCR)</b>
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): PCR 2019:14, version 1.3.1
PCR review was conducted by: <i>The Technical Committee of the International EPD® System. See <a href="http://www.environdec.com">www.environdec.com</a> for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat <a href="http://www.environdec.com/contact">www.environdec.com/contact</a>.</i>
<b>Life Cycle Assessment (LCA)</b>
LCA accountability: Lee Hui Yin, Eugene Ho Hong Zhuang, <i>Singapore Institute of Manufacturing and Technology (SIMTech)</i>
<b>Third-party verification</b>
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:  <input checked="" type="checkbox"/> EPD verification by individual verifier  Third-party verifier: Joanna Zhuravlova, Bureau Veritas Polska  Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier:  <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

## Company Information

### Owner of the EPD:

Technoform Edge Bond Solutions Singapore Pte Ltd  
32 Pioneer Crescent West Park, Bizcentral, #05-18/19, 628561, Singapore

### Contact:

Benjamin Teoh, *benjamin.teoh@ap.technoform.com*

### Description of the organisation:

Technoform is a global market leader in the field of high precision thermal insulation profiles for aluminium windows, doors and façades, and thermal insulation components for energy efficient insulating glass. With over 50 years of know-how and technical expertise, we have established a reputation for providing high quality solutions that meet stringent requirements globally.

Worldwide, Technoform is present with more than 45 sales offices and over 1,600 employees. Our global team of passionate people seek to connect with forward-looking and like-minded organizations. Together, we hope to make the world better and more sustainable, one building façade at a time.

### Product-related or management system-related certifications:

ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 certificate, Singapore Green Building Product Certificate for Technoform Warm Edge Spacer, SP12, SP13 & SP14.

### Name and location of production site(s):

Technoform Edge Bond Solutions Singapore,  
32 Pioneer Crescent West Park, Bizcentral, #05-18/19, 628561, Singapore.

## Product Information

### Product name:

Technoform Warm Edge Spacer, SP12, SP13 & SP14

### Product identification:

A “warm edge spacer” used for sealed insulating glass unit is defined by EN ISO 10077-2 as having a thermal conductance of less than 0.007 W/K.

### Product description:

Technoform warm edge spacer is a thermally improved spacer, made of polypropylene and stainless steel, allowing it to substantially reduce heat transfer at the edge of the glass.

Benefits of using a warm edge spacer include:

- Improves thermal performance at the edge of the glass while maintaining exceptional durability
- Reduces risk of condensation at the edge of the glass
- Reduces building envelope heat gain
- Lowers electrical consumption and carbon emission due to cooling and heating
- Improves indoor comfort
- Increases productivity during the fabrication of insulating glass units

### UN CPC code:

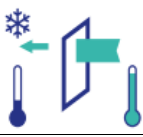
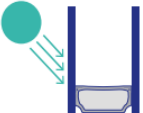
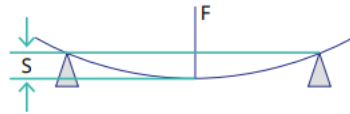

363, Semi-manufactures of plastics & 412, Products of iron or steel

Geographical scope:



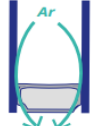
The data and information originate from the production site for warm edge spacer in Technoform Edge Bond Solutions Singapore.

Technical specification:

**Tests for Technoform warm edge spacer**

Test	Reference Standard & Product Performance	Significance
<b>Thermal Conductivity</b> 	EN ISO 12664-01 $\lambda_{eq, 2B} = 0.31 \text{ W/(m} \cdot \text{K)}$	Verified thermal conductivity suitable for use in thermal simulation modelling
<b>UV Resistance</b> 	EN ISO 4892-2 No significant color change after 4000 h	Ensures minimal color degradation even after long term exposure to sunlight
<b>Mechanical Performance (3 point bending test)</b> 	EN ISO 178 $R_{p0.2} \geq 40 \text{ N/mm}^2$ reference	Ensures the mechanical properties of the spacer for easy handling
<b>Adhesion Test</b> 	EN 1279, Auto Clave Min. 100N	Good adhesion between barrier foil and sealant ensures minimal gas leakage and moisture penetration, increasing durability of IGU

**Tests for insulating glass**

Test	Reference Standard & Product Performance	Significance
<b>Moisture Penetration</b> 	EN 1279-2	Provide for a durable vapor and moisture barrier
<b>Release of VOC</b> 	EN 1279-6, Annex G < 0.02 %	Ensures materials are resistant to off-gassing when exposed to UV, reducing the risk of volatile fogging
<b>Air Leakage</b> 	EN 1279-3 Max. 1% per year	Provide for an air-tight IGU construction

## Information Related on EPDs of Multiple Products:

### Representative Product:

Technoform SP14 warm edge spacer with a width of 12mm

### Justification of representativeness:

Despite the differences in characteristics and width, these products share similar material and are manufactured at a single site in Singapore by Technoform. They follow identical core processes, leading to an expected similarity in their environmental impact per unit weight.

The production volume of SP13/14 with a 12mm width was the highest between August 2021 and April 2023. It also was expected that SP14 would have a slightly worse environmental performance compared to SP13 due to the inclusion of an extra component, steel wire.

### Calculation of result:

In order to determine the environmental impacts per linear metre associated with different product width and models, the results indicated in this EPD must be multiplied by the corresponding multiplication factor based on their weight, as indicated in page 13.

## LCA Information

### Declared unit:

One linear metre of a packaged Technoform SP14 warm edge spacer with a width of 12mm and a weight of 0.0528kg, used for sealed insulating glass unit.

To convert the result to mass, the results indicated in this EPD may be divided by 0.0528 kg/m length.

### Reference service life:

Not applicable

### Time representativeness:

Data input based on production data between August 2021 and April 2023.

13 sampling months were chosen based on their high production percentage of the SP12, SP13, and SP14 warm edge spacer models.

### Database(s) and LCA software used:

Model in Microsoft Excel with ecoinvent Database 3.9.1  
(System Model: Allocation, cut-off, EN15804)

### Allocation method:

Mass allocation at plant level. In view of the similarities in the production processes among these products, the data is averaged to the declared unit based on the total weight of the finished product produced across the 13 sample months. There is no scrap material as the input material in the Technoform production.

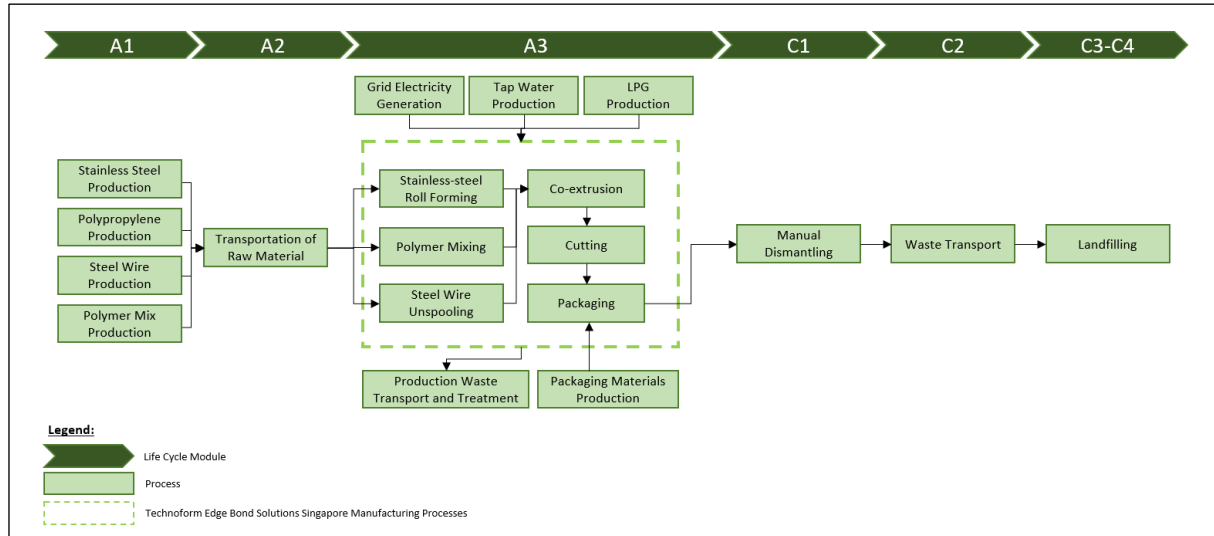
### Cut-off rule:

No cut-off criterion has been applied. All the processes and inputs/ outputs were included in the calculations. Minor miscellaneous items for which no data monitored is amount to less than 1% of the total weight per declared unit.

## Description of system boundaries:

The system boundary was chosen based on the goal of the study and in accordance cradle to gate with modules C1-C4 and Module D (A1-A3, C1-C4 and D)

## System diagram:



### Module A1:

This stage involves the extraction and processing of raw materials used as the components of the warm edge spacer.

### Module A2:

This stage involves the upstream transportation of raw materials from their respective supplier sites to Technoform Edge Bond Solutions Singapore factory gate. This transportation involved both sea transportation by containerships and land transportation by heavy-duty trucks (16-32 metric ton, EURO6).

### Module A3:

This stage involves the manufacturing of Technoform warm edge spacer in Technoform Edge Bond Solutions Singapore. This stage includes several core processes to produce the Technoform warm edge spacers.

1. Roll forming shapes the stainless steel.
2. Polymer mixing combines polypropylene with polymer mix.
3. Steel wire is unspooled to provide reinforcement.
4. Co-extrusion combines roll-formed stainless steel and polymer mix to create spacer shapes.
5. Cutting operation ensures the correct product length.
6. Finally, warm edge spacers are packaged for distribution and use.

### Module C1:

This stage assumes the manual dismantling of the Technoform warm edge spacer from buildings, requiring no additional energy or materials.

### Module C2:

This stage assumes the transportation of discarded products to a waste disposal area using heavy-duty trucks (16-32 metric ton, EURO6) over a 50km distance.

**Module C3:**

This stage assumes no additional waste processing is required before disposal.

**Module C4:**

This stage assumes the product undergoes landfill disposal.

**Module D:**

No specific impacts or benefits are allocated to this stage, as the product is assumed to be 100% landfilled in module C.

Life Cycle Impact Assessment Method:

EN 15804 reference package based on EF 3.1

Inclusion of Infrastructure and Capital Goods:

Within ecoinvent Database, the production of infrastructure and capital goods was included, resulting in the consideration of these aspects in processes outside Technoform Edge Bond Solutions Singapore operational control. However, the production of infrastructure and capital goods used in the core processes at Technoform Edge Bond Solutions Singapore manufacturing site were not included.

Electricity mix modelling:

In this LCA study, Singapore grid electricity mix was used in A3, aligning with the production site location. The electricity modelling was based on the "market for medium voltage, SG" dataset from the ecoinvent database, with GWP results of 0.50 kg CO<sub>2</sub>eq. / kwh.

Balancing out reporting:

The packaging contains more than 5% biogenic carbon, as module A5 is not included in this EPD, the A1-A3 results includes the "balancing-out reporting" of the biogenic CO<sub>2</sub> of packaging released in module A5.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	DE, CN, MY, TH	GLO	SG	-	-	-	-	-	-	-	-	-	GLO	GLO	GLO	GLO	GLO
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	44% per metre length; <10% per unit weight			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	One manufacturing site, 0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

( Note: Modules declared noted with “X”. Modules not declared marked as “ND”.)

(Acronyms: DE: Germany, CN: China, MY: Malaysia, TH: Thailand, GLO: Global, SG: Singapore)



## Content Information

Product components per one linear metre of a Technoform SP14 warm edge spacer with a width of 12mm			
Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/ kg
Stainless Steel	1.81E-02	0	0
Polypropylene	2.15E-02	0	0
Steel Wire	1.97E-03	0	0
Polymer Mix	1.54E-03	0	0
<b>TOTAL</b>	<b>4.31E-02</b>	<b>0</b>	<b>0</b>

Packaging materials per one linear metre of a Technoform SP14 warm edge spacer with a width of 12mm			
Packaging materials	Weight, kg	Weight-% (versus the product)	Weight biogenic carbon, kg C/ kg
Wooden Crate	9.20E-03	21.37%	3.83E-01
PE Sheet	1.14E-04	0.26%	0
Corrugated Board	3.64E-04	0.84%	4.25E-01
Metal Strap	8.15E-05	0.19%	0
<b>TOTAL</b>	<b>9.76E-03</b>	<b>22.67%</b>	<b>-</b>

The list of components does not include products included in the “Candidate List of Substances of Very High Concern for Authorizations” by European Chemicals Agency (ECHA).

## Results of the Environmental Performance Indicators

### Mandatory impact category indicators according to EN 15804

Results per one linear metre of a packaged Technoform SP14 warm edge spacer with a width of 12mm								
Indicator		Unit	Total A1-A3	C1	C2	C3	C4	D
Global Warming Potential - fossil fuels	GWP-fossil	kg CO <sub>2</sub> eq.	2.20E-01	0.00E+00	4.06E-04	0.00E+00	2.34E-03	0.00E+00
Global Warming Potential - biogenic	GWP-biogenic	kg CO <sub>2</sub> eq.	3.20E-04	0.00E+00	1.07E-07	0.00E+00	2.40E-02	0.00E+00
Global Warming Potential - land use and land use change	GWP-luluc	kg CO <sub>2</sub> eq.	1.94E-04	0.00E+00	2.14E-07	0.00E+00	9.40E-07	0.00E+00
Global Warming Potential - total	GWP-total	kg CO <sub>2</sub> eq.	2.21E-01	0.00E+00	4.06E-04	0.00E+00	2.63E-02	0.00E+00
Depletion potential of the stratospheric ozone layer	ODP	kg CFC 11 eq.	2.40E-09	0.00E+00	6.39E-12	0.00E+00	1.52E-11	0.00E+00
Acidification potential, Accumulated Exceedance	AP	mol H <sup>+</sup> eq.	1.08E-03	0.00E+00	1.00E-06	0.00E+00	7.40E-06	0.00E+00
Eutrophication potential, fraction of nutrients reaching freshwater end compartment	EP-freshwater	kg P eq.	5.36E-05	0.00E+00	3.32E-08	0.00E+00	6.86E-07	0.00E+00
Eutrophication potential, fraction of nutrients reaching marine end compartment	EP-marine	kg N eq.	2.21E-04	0.00E+00	2.45E-07	0.00E+00	7.70E-05	0.00E+00
Eutrophication potential, Accumulated Exceedance	EP-terrestrial	mol N eq.	2.33E-03	0.00E+00	2.52E-06	0.00E+00	2.09E-05	0.00E+00
Formation potential of tropospheric ozone	POCP	kg NMVOC eq.	8.53E-04	0.00E+00	1.34E-06	0.00E+00	1.59E-05	0.00E+00
Abiotic depletion potential for non-fossil resources	ADP-minerals & metals*	kg Sb eq.	2.74E-06	0.00E+00	1.35E-09	0.00E+00	2.76E-09	0.00E+00
Abiotic depletion for fossil resources potential	ADP-fossil*	MJ	3.90E+00	0.00E+00	5.76E-03	0.00E+00	1.49E-02	0.00E+00
Water (user) deprivation potential, deprivation-weighted water consumption	WDP*	m <sup>3</sup>	6.59E-02	0.00E+00	2.74E-05	0.00E+00	1.37E-04	0.00E+00

**\* Disclaimer:**

- The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.
- The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.
- The results of the impact categories abiotic depletion of minerals and metals, land use, human toxicity (cancer), human toxicity, non-cancer and ecotoxicity (freshwater) may be highly uncertain in LCAs that include capital goods/infrastructure in generic datasets in case infrastructure/capital goods contribute greatly to the total results. This is because the LCI data of infrastructure/capital goods used to quantify these indicators in currently available generic datasets sometimes lack temporal, technological and geographical representativeness. Caution should be exercised when using the results of these indicators for decision-making purposes.
- According to PCR, discourage the use of the results of modules A1-A3 without considering the results of module C.

## Additional mandatory and voluntary impact category indicators

Results per one linear metre of a packaged Technoform SP14 warm edge spacer with a width of 12mm							
Indicator	Unit	Total A1-A3	C1	C2	C3	C4	D
GWP-GHG <sup>1</sup>	kg CO <sub>2</sub> eq.	2.21E-01	0.00E+00	4.06E-04	0.00E+00	2.63E-02	0.00E+00

## Resource use indicators

Results per one linear metre of a packaged Technoform SP14 warm edge spacer with a width of 12mm								
Indicator		Unit	Total A1-A3	C1	C2	C3	C4	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ	4.53E-01	0.00E+00	7.37E-05	0.00E+00	-3.05E-01	0.00E+00
Use of renewable primary energy resources used as raw materials	PERM	MJ	1.48E-01	0.00E+00	0.00E+00	0.00E+00	3.05E-01	0.00E+00
Total use of renewable primary energy resources	PERT	MJ	6.01E-01	0.00E+00	7.37E-05	0.00E+00	6.96E-04	0.00E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ	2.74E+00	0.00E+00	5.76E-03	0.00E+00	-1.85E-01	0.00E+00
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ	1.15E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-01	0.00E+00
Total use of non-renewable primary energy re-sources	PENRT	MJ	3.90E+00	0.00E+00	5.76E-03	0.00E+00	1.49E-02	0.00E+00
Use of secondary material	SM	kg	1.26E-02	0.00E+00	2.59E-06	0.00E+00	6.06E-06	0.00E+00
Use of renewable secondary fuels	RSF	MJ	7.27E-05	0.00E+00	3.34E-08	0.00E+00	1.55E-07	0.00E+00
Use of non-renewable secondary fuels	NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	FW	m <sup>3</sup>	1.19E-03	0.00E+00	7.05E-07	0.00E+00	1.31E-05	0.00E+00

<sup>1</sup> This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO<sub>2</sub> is set to zero.

## Waste indicators

Results per one linear metre of a packaged Technoform SP14 warm edge spacer with a width of 12mm							
Indicator	Unit	Total A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.31E-02	0.00E+00	4.43E-06	0.00E+00	2.61E-05	0.00E+00
Non-hazardous waste disposed	kg	2.45E-01	0.00E+00	1.40E-04	0.00E+00	9.42E-04	0.00E+00
Radioactive waste disposed	kg	2.25E-06	0.00E+00	1.17E-09	0.00E+00	1.33E-08	0.00E+00

## Output flow indicators

Results per one linear metre of a packaged Technoform SP14 warm edge spacer with a width of 12mm							
Indicator	Unit	Total A1-A3	C1	C2	C3	C4	D
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	6.92E-04	0.00E+00	4.48E-08	0.00E+00	3.54E-07	0.00E+00
Materials for energy recovery	kg	1.55E-06	0.00E+00	3.65E-10	0.00E+00	1.06E-09	0.00E+00
Exported energy, electricity	MJ	2.95E-03	0.00E+00	4.12E-07	0.00E+00	4.75E-06	0.00E+00
Exported energy, thermal	MJ	2.02E-03	0.00E+00	8.49E-07	0.00E+00	1.44E-06	0.00E+00

## Multiplication factor for other product width and models

In this EPD report, all results are presented with reference to the packaged Technoform SP14 warm edge spacer with a width of 12mm, which serves as the representative product for this assessment. To obtain the environmental impacts for the other product, multiply the result for the packaged Technoform SP14 warm edge spacer with a width of 12mm by the corresponding multiplication factor listed in the table below for that product model and width.

No	Product model	Product width (mm)	Packaged product weight per metre length (kg)	Result multiplication factor
1	SP12	8	4.30E-02	0.81
2		9	4.25E-02	0.80
3	SP13	10	4.75E-02	0.90
4		12	5.07E-02	0.96
5		14	5.58E-02	1.06
6		15	5.83E-02	1.10
7		16	6.09E-02	1.15
8		18	6.72E-02	1.27
9		20	7.42E-02	1.40
10	SP14	10	4.94E-02	0.94
11		12	5.28E-02	1.00
12		14	5.79E-02	1.10
13		15	6.04E-02	1.14
14		16	6.30E-02	1.19
15		18	6.94E-02	1.31
16		20	7.63E-02	1.44

## References

- ecoinvent Centre. (2021). ecoinvent database version 3.9.1 Available from <https://www.ecoinvent.org/database/database-39.html>
- Energy Authority Market Singapore. (n.d.). Energy Transformation. Retrieved 3 August 2023, from <https://www.ema.gov.sg/singapore-energy-statistics/Ch02/index2>
- EPD International. (2019). General Programme Instructions of the International EPD® System. Version 3.01. EPD International.
- EPD International. (2023). Product Category Rules PCR 2019:14 Construction Products Version 1.3.1 EPD International
- European Committee for Standardization. (2019). Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products (EN 15804:2012+A2:2019). European Committee for Standardization
- ISO. (2018a). Environmental management - Life cycle assessment - Requirements and guidelines. ISO 14044:2006, May.
- ISO. (2018b). Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification and communication
- ISO. (2020). Environmental management — Life cycle assessment — Principles and framework. ISO 14040:2006, May.
- Singapore National Environmental Agency. (n.d.). Solid Waste Management Infrastructure. Retrieved 17 August 2023, from <https://www.nea.gov.sg/our-services/waste-management/waste-management-infrastructure/solid-waste-management-infrastructure>
- U.S Environmental Protection Agency. (2008). AP42 1.5 Liquefied Petroleum Gas Combustion, update July 2008. <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors>

