ALUMINUM
SPACER H 65

CHROMATECH
ULTRA F

MULTITECH G

THERMIX
TX PRO

Environmental Product Declaration

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
Reference GPI:	General Programme Instructions IES v3.01
Reference PCR:	PCR 2019:14 v1.11 “Construction products”, CPC 363 & 415
Registration number:	S-P-08910
Geographical scope:	Global
Date of publication:	2023/03/24
Date of approval:	2023/03/23
Valid until:	2028/03/23

In conformity with ISO 14025 and EN 15804:2012+A2:2019

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.

Verification and registration

The LCA and EPD have been produced by ALU-PRO in collaboration with 2B Srl (www.to-be.it).

According to ISO 14025, EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804:2012+A2:2019.

ISO standard ISO 21930 and CEN standard EN 15804:2012+A2:2019 serves as the core Product Category Rules (PCR)

Product category rules (PCR):
PCR 2019:14 Construction products, version 1.11
UN CPC 363 & 415 category

PCR review was conducted by:
The Technical Committee of the International EPD® System. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.

Independent third-party verification of the declaration and data, according to ISO 14025:2006:
■ External ☐ Internal
covering
☐ EPD process certification ■ EPD verification

Address of programme operator: EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden, E-mail: info@environdec.com

In case of individual verifiers: Guido Croce
Approved by: The International EPD® System Technical Committee, supported by the Secretariat

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Procedure for follow-up during EPD validity involves third party verifier:
■ Yes ☐ No

The company

ALU-PRO is the only company in the world supplying the widest range of spacer bars to the glass manufacturing and processing industry.
Our spacers made of aluminum, plastic and combined steel and special plastic materials provide the perfect solution to satisfy all your needs.
At ALU-PRO you will find a world leader in the production of spacer bars for glazed units with the most up-to-date equipment and dedicated to providing the perfect spacer for every single project.
An ALU-PRO spacer is more than "just" a spacer: it is the culmination of years of experience coupled with the latest knowledge and designed with an eye for detail, the environment and your needs.
We supply spacers which actively contribute to less condensation, extend the lifetime of windows and provide a more comfortable indoor temperature. These are just some of the advantages of the new warm edge spacer bars which furthermore reduce energy bills and, correspondingly, CO2 emissions [1].

The EPD owner is ALU-PRO Srl

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ALUMINUM
SPACER H 65
A155

The products

ALUMINUM SPACER H 65 is produced using special aluminum alloys and in different thicknesses depending on its use. The profile is characterised by a height H of 6.5 mm, lengths of 4, 5 and 6 meters and a width L from 4 to 26.5 mm. The spacers are packaged either in 4, 5 and 6 meter cardboard boxes or in 5 and 6 meter steel containers with different content capacities. In the steel containers, the profiles can be arranged either side-by-side, with separation paper between layers, or taped in bundles of 17 units. ALUMINUM SPACER H 65 can be used for the production of frames with angles or bent by all profile benders on the market today. In this case, on request, it can be supplied with linear fittings, made of plastic or steel, already inserted in the end pieces [2].
The characteristics of the ALUMINUM SPACER H 65 A155 profile analysed in this study are shown in Table 1.

ALUMINUM SPACER H 65 A155		
Characteristics	Quantity	Unit
Length	1	m
Width	15.5	mm
Height	6.5	mm
Thickness	0.35	mm
Weight	38.98	g/m

Table 1 - Features of ALUMINUM SPACER H 65 A155 analysed.

CHROMATECH ULTRA F U155

The products

CHROMATECH ULTRA F is a modern composite profile consisting of a stainless steel structure reinforced with ribs (parallel and transverse) and a plastic top. The profile has a height H of 6.9 mm, a length of 5 and 6 meters and a width L ranging from 7.5 to 23.5 mm. The steel thickness of 0.10 mm makes it strong and at the same time flexible. The spacers, bound in bundles of 16 bars, are packed either in cardboard boxes or steel containers. CHROMATECH ULTRA F can be cut to form frames with plastic corners or bent by all profile benders on the market today [3].
The characteristics of the CHROMATECH ULTRA F U155 profile analysed in this study are shown in Table 2.

CHROMATECH ULTRA F U155		
Characteristics	Quantity	Unit
Length	1	m
Width	15.5	mm
Height	6.9	mm
Steel thickness	0.104	mm
Plastic thickness	0.9	mm
Weight	58.1	g/m

Table 2 - Features of CHROMATECH ULTRA F U155 analysed.

MULTITECH G
M155

The products

MULTITECH G is a state-of-the-art spacer made of reinforced plastic copolymer with a special transparent, gas-tight multilayer film applied and with exceptional thermal performance. Thanks to the special performance of the multilayer barrier, which is metal-free and extremely thin but exceptionally strong, MULTITECH G, among warm edge products, ranks as the one with the best linear thermal transmittance performance (Psi). MULTITECH G has a height H of 6.5 mm, a length of 5 and 6 meters and a width L ranging from 7.5 to 26.5 mm. The thickness of 0.9 mm makes it strong and very rigid. The rods are packed both in cardboard boxes of 5 meters and in steel containers, with different content capacities, of 5 and 6 meters. The rods, both in boxes and in steel containers, are taped in bundles of 16 profiles. MULTITECH G can be folded with profile benders equipped with a heating option, welded with special tools or more simply cut and assembled with the specific corner accessories [4].
The characteristics of the MULTITECH G M155 profile analysed in this study are shown in Table 3.

MULTITECH G M155		
Characteristics	Quantity	Unit
Length	1	m
Width	15.5	mm
Height	6.5	mm
Thickness	0.95	mm
Weight	51	g/m

Table 3 - Features of MULTITECH G M155 analysed.

THERMIX
TX PRO T155

The products

THERMIX TX PRO is a modern profile made from a special technopolymer, stiffened with two high-strength stainless steel wires. The profile is partially covered with a very thin stainless steel foil that performs the dual function of sealant adhesion support and barrier to the passage of gases. The spacer has a height H of 6.85 mm, a length of 5 and 6 meters and a width L ranging from 7.5 to 23.5 mm. The thickness of 0.10 mm makes it both strong and flexible. The rods are packed in both 5- and 6-meter cardboard boxes and 5- and 6-meter steel containers with different content capacities. The rods, both in boxes and in steel containers, are joined in bundles of 11 profiles. THERMIX TX PRO can be cut to form frames with plastic corners or bent by all profile benders on the market today [5]. The characteristics of the THERMIX TX PRO T155 profile analysed in this study are shown in Table 4.

THERMIX TX PRO T155		
Characteristics	Quantity	Unit
Length	1	m
Width	15.5	mm
Height	6.85	mm
Steel thickness	0.09	mm
Plastic thickness	0.9	mm
Wire steel thickness	0.7	mm
Weight	52.01	g/m

Table 2 - Features of CHROMATECH ULTRA F T155 analysed.

The production of spacer profiles for insulating glass is carried out in several stages, ranging from the acquisition of raw materials to the packaging of the final product. The main and essential stages of processing by ALU-PRO are as follows:

- coil cutting;
- profiling;
- plastic extrusion;
- material handling;
- handling finished products.

The main production steps of the analysed profiles are shown in Figure 1.

Production phases

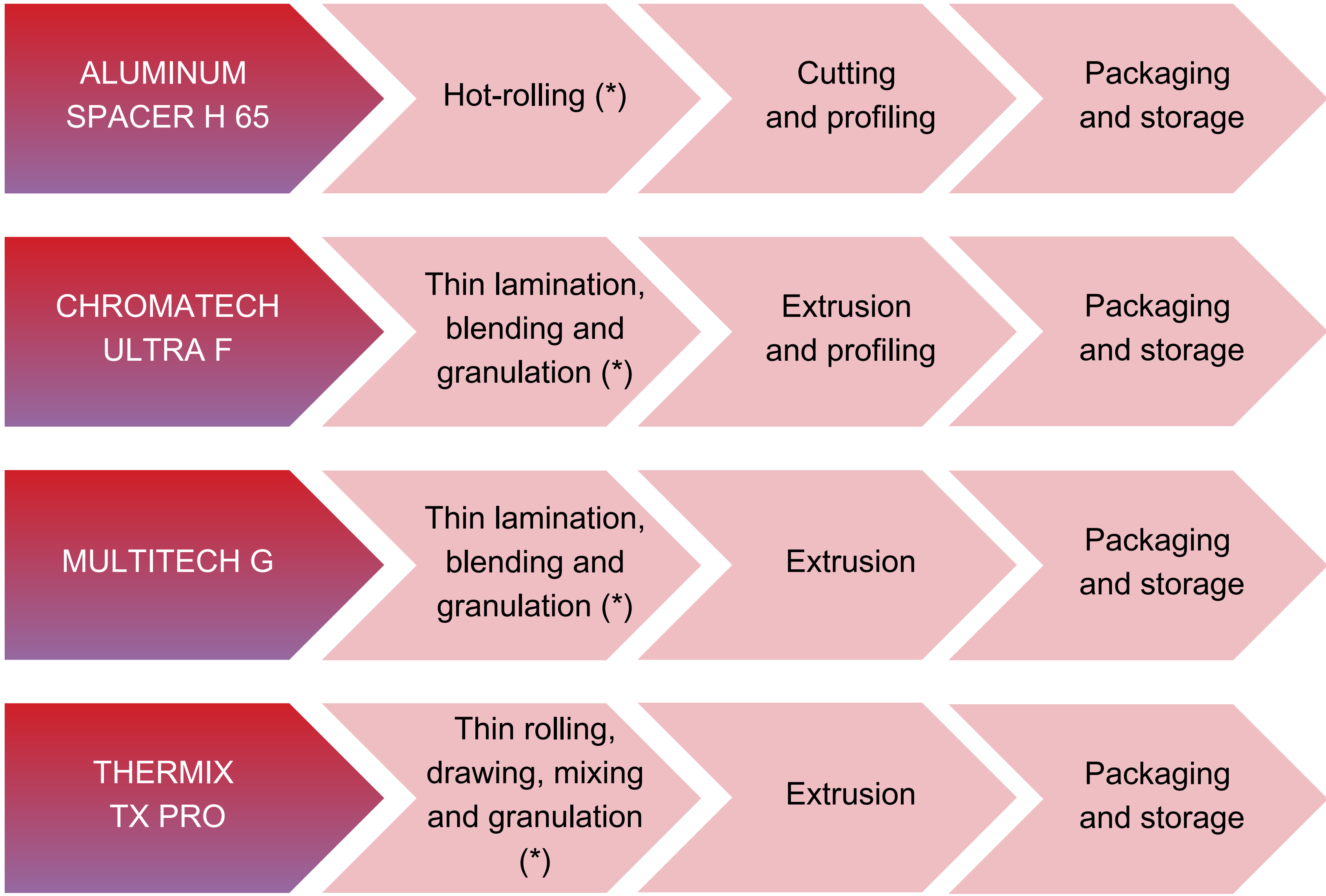


Figure 1 - Summary of the main production processes of the analysed profiles. Steps marked with (*) are not carried out by ALU-PRO.

ALUMINUM
SPACER H 65
A155

Production materials

Spacer profile	Material	Weight (kg)	%	% post-consumer material
ALUMINUM SPACER H 65 A155	Aluminum	0.039	87.8	36
	Subtotal	0.039	87.8	
	Cardboard	0.003	7.5	0
	Wood	0.001	2.7	0
	Paper	0.001	1.6	0
	Steel	0.000	0.4	0
	Subtotal	0.005	12.2	
	Total	0.044	100	

Table 5 - Materials and weights of spacer profiles and their packaging analysed.

CHROMATECH
ULTRA F U155

Production materials

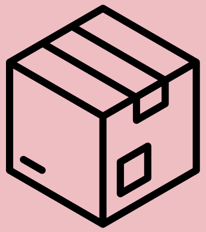
Spacer profile	Material	Weight (kg)	%	% post-consumer material
CHROMATECH ULTRA F U155	PVC	0.033	50.6	0
	Steel	0.024	37.5	90
	Glue	0.001	2.0	0
	Subtotal	0.058	90.1	
	Cardboard	0.005	7.6	0
	Wood	0.001	2.0	0
	Steel	0.000	0.3	0
	PP	0.000	0.1	0
	Subtotal	0.006	9.9	
	Total	0.064	100	

Table 5 - Materials and weights of spacer profiles and their packaging analysed.

MULTITECH G
M155

Production materials

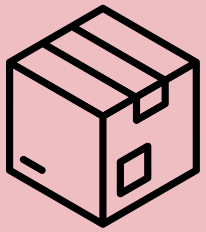
Spacer profile	Material	Weight (kg)	%	% post-consumer material
MULTITECH G M155	SAN + GF	0.048	83.6	0
	PET	0.002	3.5	0
	Glue	0.001	1.7	0
	Subtotal	0.051	88.8	
	Cardboard	0.005	8.5	0
	Wood	0.001	2.2	0
	Steel	0.000	0.3	0
	PP	0.000	0.1	0
	Subtotal	0.006	11.2	
	Total	0.057	100	

Table 5 - Materials and weights of spacer profiles and their packaging analysed.

THERMIX
TX PRO T155

Production materials

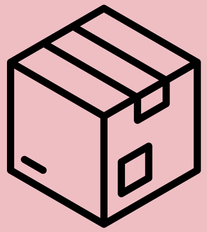
Spacer profile	Material	Weight (kg)	%	% post-consumer material
THERMIX TX PRO T155	PP	0.027	46.2	0
	Steel	0.022	38.4	90
	Glue	0.003	4.5	0
	Subtotal	0.052	89.1	
	Cardboard	0.005	8.7	0
	Wood	0.001	1.8	0
	Steel	0.000	0.3	0
	PP	0.000	0.1	0
	Subtotal	0.006	10.9	
	Total	0.058	100	

Table 5 - Materials and weights of spacer profiles and their packaging analysed.

DECLARED UNIT

The declared unit considered in this study, for all 4 insulating glass spacer profiles analysed, is 1m of profile. The packaging of each profile is also considered in the study.

LCA information

	Product stage			Manufacturing 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
Module declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	WLD	EU	IT	-	-	-	-	-	-	-	-	-	WLD	WLD	WLD	WLD	WLD
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - product	>10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - sites	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6 - Life cycle stages of spacer profiles for insulating glass units according to the criteria of EN 15804:2012+A2:2019.

LCA information

SYSTEM BOUNDARIES

This LCA study is a Cradle to Gate analysis with modules C1-C4 and module D. Therefore, the LCA system boundaries of the 4 profiles include the production of raw materials for the profiles and the production of packaging materials, their transport, the construction phase of the profiles, their packaging and final disposal. The system boundaries are shown in Table 6, where phases included in this study are marked with an “X” and those not included with “ND”.

UPSTREAM

A1 - Raw material supply
Extraction and production of raw materials for profiles and their packaging

CORE

A2 - Transport
Transport of processed raw materials to the ALU-PRO production site

A3 - Manufacturing
Processing of materials for profile production and related consumption; Treatment of waste produced during production stages; Packaging and storage of finished product

DOWNSTREAM

C1, C2, C3 e C4 - End-of-Life stage
Transport of profiles to disposal sites; Disposal and end-of-life treatments

Figure 2 - System boundaries of the 4 analysed spacer profiles.

LCA information

TIME BOUNDARIES

The primary data were provided by ALU-PRO and refer to the year 2021. The corporate emissions data refer to the year 2022. Secondary data were obtained from the ecoinvent v3.8 database [11], published in 2021.

GEOGRAPHICAL BOUNDARIES

The production and packaging of the 4 profiles is carried out in the ALU-PRO factory located in Noale (province of Venice) at “Via Albert Einstein, 8, 30033 Noale (VE)”.
The materials for the profiles and their packaging are produced in Belgium, Germany, Italy, the Kingdom of Bahrain, Romania and the United States. Since the profiles are sold both in Italy and abroad, the end-of-life scenario refers to a global context.

LIFE CYCLE BOUNDARIES

The following processes have been excluded: the building of production machinery, buildings and other equipment; personnel work trips; research and development activities, including the production and building of laboratory equipment; maintenance activities.
Infrastructure, when present, was not excluded in the processes derived from the ecoinvent v3.8 database [11].

LCA information

DATA QUALITY

Both primary and secondary data were used. Primary data were gathered and provided by ALU-PRO through the filling of questionnaires and direct communication; when primary data were not available, secondary data were used.
As secondary data, the ecoinvent v3.8, allocation, cut-off by classification [11] data and data found in the literature were used. The ecoinvent database is available in SimaPro 9.4 [12], the software used for calculations.
The life cycle analysis must consider at least 99% of the total energy and mass flows of the product and its packaging. Proxy data can be also used in case there are gaps in the required data, provided that their contribution to the environmental performance assessment does not exceed 10% for every main impact category. The use of proxy data does not exceed 10% for each main impact category.

ALLOCATION RULES

Allocation represents the subdivision procedure through which inputs and outputs of the system are divided within the different products in order to represent their underlying physical relationships.
The processes influencing the environmental profile of the product during its life cycle must be allocated within the life cycle unit where those same processes occur. This way, the sum of the allocated flows at the entrance and at the exit corresponds to the sum of the flows at the entrance and at the exit: a double counting is avoided and none of the flows at the entrance and at the exit are omitted.
The electricity consumption, emissions, water use and waste production of the factory and warehouse over the time period considered were allocated according to the total production in meters of the 4 spacer profiles for insulating glass analysed during the reference year.
Raw materials and production processes were included for virgin resources. No allocation was applied on recyclable materials. As an input for the recycled resources the recycling process is included. The outputs subject to recycling are considered as inputs for the next life cycle.

Inventory

This EPD is based on primary data for the fundamental aspects of the study, i.e. the weight of the materials for the spacer profiles and their packaging and the plant energy consumption.

Primary data were gathered and provided by ALU-PRO through the filling of questionnaires, bills, safety data sheets and direct communication. Secondary data are used for all the processes that lack primary data, e.g. the production of the individual components and the packaging, the processing of some raw materials and the disposal of the final product and its packaging. For the secondary data the ecoinvent v3.8, allocation, cut-off by classification database [11] and literature data were used.
The life cycle analysis has considered all total energy and mass flows of the product and its packaging, so no cut-off rules were applied.
As requested by PCR 2019:14 v1.11 [7], the use of proxy data is limited and their contribution does not exceed 10% of the total impact of the considered impact categories.
Within the LCA all the constitutive elements of the 4 spacer profiles were evaluated.
With regards to the electricity consumption during the production and storage steps, the process “Electricity, medium voltage {IT}| market for |”, derived from the ecoinvent database, was modified using the national residual energy mix.
For the transport to the disposal route of the product and its packaging, road transport was assumed (16-32 t EURO 4 lorry) for 100 km.
For all profile types, neither energy nor material consumption was considered for their removal and dismantling.
For profiles and packaging, a disposal scenario with global average data was created as profiles are considered to be sold worldwide. For the creation of the treatment processes of recycling, incineration and landfill, statistical average data from OECD databases were considered [15].
Module D assesses the impact of the net flows of recovered materials (recycled or reused) from the life cycle stages A to C, as required by EN 15804: 2012 + A2: 2019 [8].

Environmental Impact Indicators

The following tables show the environmental impact indicators of the life cycle of the 4 spacer profiles, as indicated by PCR 2019:14 v1.11 [7] and EN 15804:2012+A2:2019 [8]. The indicators are subdivided into the contribution of the processes at the different product phases considered, as requested by PCR 2019:14, i.e. units A1-A3, C1-C4 and D.

LCA stages		Description
A1	Raw material supply	• Extraction and production of raw materials • Generation of electricity and heat
A2	Transport	• Transport of raw materials and packaging materials to the production site
A3	Manufacturing	• Production of packaging • Production and packaging of the final product • Plant and warehouse consumption • Waste treatment in the production site
C1	De-construction / demolition	• Manual operation
C2	End-of-Life transport	• Transport of spacer profiles to final disposal
C3	Waste processing	• No specific treatments before the disposal of the spacer profiles
C4	Disposal	• Spacer profiles disposal

Table 7 - Life cycle stages considered in the calculation of the environmental impacts of the 4 spacer profiles for insulating glass.

ALUMINUM SPACER H 65 A155

Impact category	Unit	Total A1-A3	A1	A2	A3	C1	C2	C3	C4	D
Climate change (GWP)	kg CO_2 eq	5.73E-01	5.58E-01	9.99E-03	4.95E-03	0.00E+00	7.64E-04	0.00E+00	1.13E-02	-1.68E-03
Climate change - Fossil	kg CO_2 eq	5.75E-01	5.57E-01	9.98E-03	8.16E-03	0.00E+00	7.64E-04	0.00E+00	9.51E-04	-5.11E-03
Climate change - Biogenic	kg CO_2 eq	-3.46E-03	-2.29E-04	6.38E-06	-3.24E-03	0.00E+00	4.53E-07	0.00E+00	1.04E-02	3.44E-03
Climate change - Land use and LU change	kg CO_2 eq	1.56E-03	1.53E-03	4.18E-06	2.44E-05	0.00E+00	3.17E-07	0.00E+00	1.30E-06	-2.88E-06
Ozone depletion	kg CFC11 eq	2.47E-08	2.14E-08	2.22E-09	1.10E-09	0.00E+00	1.66E-10	0.00E+00	1.21E-10	-2.58E-10
Acidification	mol H^+ eq	3.78E-03	3.70E-03	5.45E-05	2.77E-05	0.00E+00	3.88E-06	0.00E+00	6.57E-06	-2.50E-05
Eutrophication, freshwater	kg P eq	1.86E-04	1.83E-04	7.01E-07	2.86E-06	0.00E+00	5.75E-08	0.00E+00	2.61E-07	-2.12E-06
Eutrophication, marine	kg N eq	6.21E-04	5.93E-04	1.54E-05	1.31E-05	0.00E+00	1.31E-06	0.00E+00	5.43E-06	-3.49E-06
Eutrophication, terrestrial	mol N eq	6.44E-03	6.19E-03	1.69E-04	8.67E-05	0.00E+00	1.43E-05	0.00E+00	1.86E-05	-5.31E-05
Photochemical ozone formation	kg NMVOC eq	1.90E-03	1.82E-03	4.96E-05	2.29E-05	0.00E+00	4.08E-06	0.00E+00	6.55E-06	-7.57E-06
Resource use, minerals and metals	kg Sb eq	3.45E-06	3.39E-06	3.32E-08	2.69E-08	0.00E+00	2.62E-09	0.00E+00	2.36E-09	-1.52E-08
Resource use, fossils	MJ	5.64E+00	5.37E+00	1.47E-01	1.27E-01	0.00E+00	1.13E-02	0.00E+00	1.40E-02	-6.89E-02
Water use (AWARE)	m^3	8.23E-02	7.76E-02	4.84E-04	4.21E-03	0.00E+00	3.96E-05	0.00E+00	2.49E-04	-9.68E-04
Particulate matter	disease inc.	4.59E-08	4.47E-08	8.27E-10	3.90E-10	0.00E+00	6.71E-11	0.00E+00	1.10E-10	-3.04E-10
Ionizing radiation	kBq U-235 eq	1.77E-02	1.64E-02	6.95E-04	6.07E-04	0.00E+00	5.21E-05	0.00E+00	7.76E-05	-5.88E-04
Ecotoxicity, freshwater	CTUe	1.49E+01	1.47E+01	1.23E-01	1.20E-01	0.00E+00	9.75E-03	0.00E+00	1.17E+01	-6.79E-02
Human toxicity, cancer	CTUh	7.19E-10	7.07E-10	3.88E-12	8.39E-12	0.00E+00	2.89E-13	0.00E+00	1.06E-12	-1.08E-11
Human toxicity, non-cancer	CTUh	1.43E-08	1.41E-08	1.20E-10	1.04E-10	0.00E+00	9.46E-12	0.00E+00	3.39E-11	-4.86E-11
Land use	Pt	1.60E+00	1.07E+00	9.71E-02	4.29E-01	0.00E+00	7.69E-03	0.00E+00	1.85E-02	-4.35E-01
Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials	MJ	5.64E+00	5.37E+00	1.47E-01	1.27E-01	0.00E+00	1.13E-02	0.00E+00	1.40E-02	-6.89E-02
Use of non-renewable primary energy resources used as raw materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use non-renew. primary energy res.	MJ	5.64E+00	5.37E+00	1.47E-01	1.27E-01	0.00E+00	1.13E-02	0.00E+00	1.40E-02	-6.89E-02
Use of renewable primary energy, excluding renewable primary energy resources used as raw materials	MJ	5.79E-01	5.65E-01	1.77E-03	1.25E-02	0.00E+00	1.31E-04	0.00E+00	7.73E-04	-6.71E-02
Use of renewable primary energy resources used as raw materials	MJ	6.88E-02	0.00E+00	0.00E+00	6.88E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use renew. primary energy res.	MJ	6.48E-01	5.65E-01	1.77E-03	8.14E-02	0.00E+00	1.31E-04	0.00E+00	7.73E-04	-6.71E-02
Use of secondary material	kg	1.49E-02	1.49E-02	0.00E+00	4.86E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	3.45E-03	3.36E-03	1.61E-05	7.17E-05	0.00E+00	1.30E-06	0.00E+00	8.09E-06	-3.49E-05
Hazardous waste disposed	kg	2.52E-04	2.51E-04	3.74E-07	2.66E-07	0.00E+00	3.00E-08	0.00E+00	1.72E-08	-5.57E-08
Non-hazardous waste disposed	kg	1.10E-01	1.01E-01	7.21E-03	1.83E-03	0.00E+00	5.77E-04	0.00E+00	2.19E-02	-6.13E-04
Radioactive waste disposed	kg	1.02E-05	8.99E-06	9.70E-07	2.89E-07	0.00E+00	7.42E-08	0.00E+00	6.00E-08	-1.80E-07

ALUMINUM SPACER H 65 A155

Impact category	Unit	Total A1-A3	A1	A2	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	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	9.12E-03	2.74E-03	0.00E+00	6.38E-03	0.00E+00	0.00E+00	0.00E+00	1.26E-02	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ per energy carrier	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.16E-03	0.00E+00
Climate change, neutral (IPCC 2013)	kg CO_2 eq	5.60E-01	5.42E-01	9.90E-03	8.27E-03	0.00E+00	7.58E-04	0.00E+00	3.87E-03	-4.92E-03

Table 8 – Impact assessment of 1m ALUMINUM SPACER H 65 A155, Method EN 15804:2012+A2:2019.

Biogenic carbon content	Unit (kg C)
Biogenic carbon content in the product	0.00E+00
Biogenic carbon content in accompanying packaging	1.67E-03

Table 9 - Biogenic carbon content of ALUMINUM SPACER H 65 A155 and its packaging.

CHROMATECH ULTRA F U155

Impact category	Unit	Total A1-A3	A1	A2	A3	C1	C2	C3	C4	D
Climate change (GWP)	kg CO_2 eq	1.68E-01	1.56E-01	8.92E-03	2.88E-03	0.00E+00	1.11E-03	0.00E+00	2.95E-02	-1.32E-02
Climate change - Fossil	kg CO_2 eq	1.69E-01	1.55E-01	8.91E-03	6.06E-03	0.00E+00	1.11E-03	0.00E+00	1.86E-02	-1.77E-02
Climate change - Biogenic	kg CO_2 eq	-1.44E-03	1.77E-03	8.02E-06	-3.21E-03	0.00E+00	6.59E-07	0.00E+00	1.09E-02	4.44E-03
Climate change - Land use and LU change	kg CO_2 eq	1.76E-04	1.41E-04	3.50E-06	3.16E-05	0.00E+00	4.61E-07	0.00E+00	2.76E-06	-1.95E-05
Ozone depletion	kg CFC11 eq	4.95E-08	4.65E-08	2.06E-09	9.68E-10	0.00E+00	2.41E-10	0.00E+00	6.17E-10	-4.33E-09
Acidification	mol H^+ eq	7.97E-04	7.30E-04	3.62E-05	3.05E-05	0.00E+00	5.63E-06	0.00E+00	1.62E-05	-7.75E-05
Eutrophication, freshwater	kg P eq	5.66E-05	5.34E-05	5.74E-07	2.66E-06	0.00E+00	8.35E-08	0.00E+00	8.40E-07	-6.20E-06
Eutrophication, marine	kg N eq	1.67E-04	1.42E-04	1.09E-05	1.45E-05	0.00E+00	1.91E-06	0.00E+00	2.84E-05	-1.26E-05
Eutrophication, terrestrial	mol N eq	1.60E-03	1.38E-03	1.19E-04	9.60E-05	0.00E+00	2.08E-05	0.00E+00	4.79E-05	-1.48E-04
Photochemical ozone formation	kg NMVOC eq	5.24E-04	4.63E-04	3.65E-05	2.46E-05	0.00E+00	5.93E-06	0.00E+00	1.49E-05	-4.60E-05
Resource use, minerals and metals	kg Sb eq	2.46E-06	2.39E-06	3.10E-08	3.30E-08	0.00E+00	3.81E-09	0.00E+00	1.87E-08	-1.40E-07
Resource use, fossils	MJ	3.15E+00	2.93E+00	1.35E-01	8.77E-02	0.00E+00	1.65E-02	0.00E+00	3.37E-02	-3.12E-01
Water use (AWARE)	m^3	1.62E-01	1.60E-01	4.06E-04	2.19E-03	0.00E+00	5.74E-05	0.00E+00	2.36E-02	-6.00E-03
Particulate matter	disease inc.	8.56E-09	7.30E-09	7.69E-10	4.87E-10	0.00E+00	9.74E-11	0.00E+00	1.65E-10	-7.08E-10
Ionizing radiation	kBq U-235 eq	2.12E-02	1.99E-02	6.93E-04	6.85E-04	0.00E+00	7.56E-05	0.00E+00	2.10E-04	-1.76E-03
Ecotoxicity, freshwater	CTUe	3.54E+00	3.31E+00	1.05E-01	1.19E-01	0.00E+00	1.42E-02	0.00E+00	9.81E-01	-2.77E-01
Human toxicity, cancer	CTUh	1.38E-09	1.36E-09	3.41E-12	8.63E-12	0.00E+00	4.20E-13	0.00E+00	3.88E-12	-1.65E-11
Human toxicity, non-cancer	CTUh	3.87E-09	3.68E-09	1.10E-10	8.49E-11	0.00E+00	1.37E-11	0.00E+00	2.82E-10	-2.07E-10
Land use	Pt	9.66E-01	5.14E-01	9.26E-02	3.60E-01	0.00E+00	1.12E-02	0.00E+00	3.10E-02	-4.73E-01
Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials	MJ	2.38E+00	2.15E+00	1.35E-01	8.60E-02	0.00E+00	1.65E-02	0.00E+00	3.37E-02	-3.12E-01
Use of non-renewable primary energy resources used as raw materials	MJ	7.76E-01	7.74E-01	0.00E+00	1.63E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use non-renew. primary energy res.	MJ	3.15E+00	2.93E+00	1.35E-01	8.76E-02	0.00E+00	1.65E-02	0.00E+00	3.37E-02	-3.12E-01
Use of renewable primary energy, excluding renewable primary energy resources used as raw materials	MJ	2.21E-01	2.29E-01	1.90E-03	-9.38E-03	0.00E+00	1.90E-04	0.00E+00	2.47E-03	-8.34E-02
Use of renewable primary energy resources used as raw materials	MJ	8.05E-02	0.00E+00	0.00E+00	8.05E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use renew. primary energy res.	MJ	3.02E-01	2.29E-01	1.90E-03	7.11E-02	0.00E+00	1.90E-04	0.00E+00	2.47E-03	-8.34E-02
Use of secondary material	kg	2.26E-02	2.25E-02	0.00E+00	5.44E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CHROMATECH ULTRA F U155

Impact category	Unit	Total A1-A3	A1	A2	A3	C1	C2	C3	C4	D
Net use of fresh water	m^3	2.57E-03	2.48E-03	1.50E-05	7.91E-05	0.00E+00	1.89E-06	0.00E+00	7.19E-04	-1.83E-04
Hazardous waste disposed	kg	3.10E-06	2.59E-06	3.52E-07	1.56E-07	0.00E+00	4.35E-08	0.00E+00	6.04E-08	-1.69E-07
Non-hazardous waste disposed	kg	6.44E-02	5.45E-02	6.93E-03	3.02E-03	0.00E+00	8.37E-04	0.00E+00	3.57E-02	-4.96E-04
Radioactive waste disposed	kg	7.96E-06	6.73E-06	9.11E-07	3.14E-07	0.00E+00	1.08E-07	0.00E+00	1.72E-07	-5.07E-07
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	1.94E-02	2.04E-03	0.00E+00	1.74E-02	0.00E+00	0.00E+00	0.00E+00	1.83E-02	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ per energy carrier	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.54E-02	0.00E+00
Climate change, neutral (IPCC 2013)	kg CO_2 eq	1.67E-01	1.51E-01	8.84E-03	6.26E-03	0.00E+00	1.10E-03	0.00E+00	2.20E-02	-1.67E-02

Table 10 - Impact assessment of 1m CHROMATECH ULTRA F U155, Method EN 15804:2012+A2:2019.

Biogenic carbon content	Unit (kg C)
Biogenic carbon content in the product	0.00E+00
Biogenic carbon content in accompanying packaging	1.47E-03

Table 11 - Biogenic carbon content of CHROMATECH ULTRA F U155 and its packaging.

MULTITECH G M155

Impact category	Unit	Total A1-A3	A1	A2	A3	C1	C2	C3	C4	D
Climate change (GWP)	kg CO_2 eq	2.11E-01	2.07E-01	9.83E-04	3.24E-03	0.00E+00	9.88E-04	0.00E+00	3.84E-02	-2.84E-02
Climate change - Fossil	kg CO_2 eq	2.13E-01	2.05E-01	9.82E-04	6.43E-03	0.00E+00	9.87E-04	0.00E+00	2.76E-02	-3.31E-02
Climate change - Biogenic	kg CO_2 eq	-1.83E-03	1.38E-03	8.83E-07	-3.21E-03	0.00E+00	5.86E-07	0.00E+00	1.08E-02	4.67E-03
Climate change - Land use and LU change	kg CO_2 eq	8.40E-05	5.18E-05	3.86E-07	3.18E-05	0.00E+00	4.10E-07	0.00E+00	5.01E-07	-2.38E-05
Ozone depletion	kg CFC11 eq	4.13E-08	4.00E-08	2.27E-10	1.11E-09	0.00E+00	2.15E-10	0.00E+00	1.24E-10	-3.99E-09
Acidification	mol H^+ eq	7.78E-04	7.42E-04	3.99E-06	3.19E-05	0.00E+00	5.01E-06	0.00E+00	8.73E-06	-1.07E-04
Eutrophication, freshwater	kg P eq	2.79E-05	2.51E-05	6.32E-08	2.70E-06	0.00E+00	7.43E-08	0.00E+00	1.10E-07	-7.06E-06
Eutrophication, marine	kg N eq	1.64E-04	1.48E-04	1.20E-06	1.49E-05	0.00E+00	1.70E-06	0.00E+00	7.31E-05	-1.80E-05
Eutrophication, terrestrial	mol N eq	1.56E-03	1.45E-03	1.31E-05	1.00E-04	0.00E+00	1.85E-05	0.00E+00	3.97E-05	-2.03E-04
Photochemical ozone formation	kg NMVOC eq	5.65E-04	5.35E-04	4.02E-06	2.53E-05	0.00E+00	5.28E-06	0.00E+00	1.19E-05	-7.23E-05
Resource use, minerals and metals	kg Sb eq	8.88E-07	8.51E-07	3.41E-09	3.44E-08	0.00E+00	3.39E-09	0.00E+00	2.25E-09	-1.38E-08
Resource use, fossils	MJ	3.94E+00	3.83E+00	1.48E-02	9.32E-02	0.00E+00	1.47E-02	0.00E+00	1.14E-02	-5.64E-01
Water use (AWARE)	m^3	9.28E-02	9.05E-02	4.47E-05	2.26E-03	0.00E+00	5.11E-05	0.00E+00	4.03E-04	-1.08E-02
Particulate matter	disease inc.	8.65E-09	8.05E-09	8.47E-11	5.12E-10	0.00E+00	8.67E-11	0.00E+00	8.39E-11	-1.11E-09
Ionizing radiation	kBq U-235 eq	1.06E-02	9.83E-03	7.63E-05	7.12E-04	0.00E+00	6.73E-05	0.00E+00	4.49E-05	-2.28E-03
Ecotoxicity, freshwater	CTUe	3.08E+00	2.94E+00	1.16E-02	1.24E-01	0.00E+00	1.26E-02	0.00E+00	3.65E-02	-4.47E-01
Human toxicity, cancer	CTUh	1.33E-10	1.24E-10	3.75E-13	8.83E-12	0.00E+00	3.74E-13	0.00E+00	1.55E-12	-1.46E-11
Human toxicity, non-cancer	CTUh	3.50E-09	3.40E-09	1.21E-11	8.87E-11	0.00E+00	1.22E-11	0.00E+00	8.98E-11	-1.45E-10
Land use	Pt	5.70E-01	1.97E-01	1.02E-02	3.63E-01	0.00E+00	9.95E-03	0.00E+00	1.75E-02	-4.63E-01
Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials	MJ	2.85E+00	2.75E+00	1.48E-02	9.15E-02	0.00E+00	1.47E-02	0.00E+00	1.14E-02	-5.64E-01
Use of non-renewable primary energy resources used as raw materials	MJ	1.09E+00	1.09E+00	0.00E+00	1.59E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use non-renew. primary energy res.	MJ	3.94E+00	3.83E+00	1.48E-02	9.31E-02	0.00E+00	1.47E-02	0.00E+00	1.14E-02	-5.64E-01
Use of renewable primary energy, excluding renewable primary energy resources used as raw materials	MJ	7.62E-02	8.52E-02	2.09E-04	-9.24E-03	0.00E+00	1.69E-04	0.00E+00	2.70E-04	-8.68E-02
Use of renewable primary energy resources used as raw materials	MJ	8.05E-02	0.00E+00	0.00E+00	8.05E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use renew. primary energy res.	MJ	1.57E-01	8.52E-02	2.09E-04	7.13E-02	0.00E+00	1.69E-04	0.00E+00	2.70E-04	-8.68E-02
Use of secondary material	kg	5.55E-05	0.00E+00	0.00E+00	5.55E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

MULTITECH G M155

Impact category	Unit	Total A1-A3	A1	A2	A3	C1	C2	C3	C4	D
Net use of fresh water	m^3	2.45E-03	2.37E-03	1.65E-06	8.09E-05	0.00E+00	1.68E-06	0.00E+00	1.21E-05	-3.10E-04
Hazardous waste disposed	kg	1.93E-06	1.72E-06	3.88E-08	1.68E-07	0.00E+00	3.88E-08	0.00E+00	3.50E-08	-1.89E-07
Non-hazardous waste disposed	kg	1.63E-02	1.09E-02	7.63E-04	4.57E-03	0.00E+00	7.46E-04	0.00E+00	2.81E-02	2.25E-05
Radioactive waste disposed	kg	3.99E-06	3.54E-06	1.00E-07	3.42E-07	0.00E+00	9.59E-08	0.00E+00	4.82E-08	-6.29E-07
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	3.44E-02	4.92E-05	0.00E+00	3.43E-02	0.00E+00	0.00E+00	0.00E+00	1.63E-02	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ per energy carrier	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-01	0.00E+00
Climate change, neutral (IPCC 2013)	kg CO_2 eq	2.05E-01	1.98E-01	9.74E-04	6.62E-03	0.00E+00	9.80E-04	0.00E+00	3.08E-02	-3.12E-02

Table 12 - Impact assessment of 1m MULTITECH G M155, Method EN 15804:2012+A2:2019.

Biogenic carbon content	Unit (kg C)
Biogenic carbon content in the product	0.00E+00
Biogenic carbon content in accompanying packaging	1.48E-03

Table 13 - Biogenic carbon content of MULTITECH G M155 and its packaging.

THERMIX TX PRO T155

Impact category	Unit	Total A1-A3	A1	A2	A3	C1	C2	C3	C4	D
Climate change (GWP)	kg CO_2 eq	1.97E-01	1.83E-01	1.10E-02	3.18E-03	0.00E+00	1.00E-03	0.00E+00	1.38E-02	-1.38E-02
Climate change - Fossil	kg CO_2 eq	1.99E-01	1.81E-01	1.10E-02	6.15E-03	0.00E+00	1.00E-03	0.00E+00	2.92E-03	-1.71E-02
Climate change - Biogenic	kg CO_2 eq	-1.62E-03	1.37E-03	9.56E-06	-2.99E-03	0.00E+00	5.96E-07	0.00E+00	1.09E-02	3.32E-03
Climate change - Land use and LU change	kg CO_2 eq	2.02E-04	1.65E-04	4.41E-06	3.24E-05	0.00E+00	4.17E-07	0.00E+00	5.45E-07	-2.05E-05
Ozone depletion	kg CFC11 eq	1.45E-08	1.10E-08	2.53E-09	9.45E-10	0.00E+00	2.18E-10	0.00E+00	1.17E-10	-7.40E-10
Acidification	mol H^+ eq	8.79E-04	7.95E-04	5.32E-05	3.10E-05	0.00E+00	5.10E-06	0.00E+00	3.87E-06	-7.27E-05
Eutrophication, freshwater	kg P eq	4.77E-05	4.43E-05	6.97E-07	2.70E-06	0.00E+00	7.55E-08	0.00E+00	1.31E-07	-5.81E-06
Eutrophication, marine	kg N eq	1.74E-04	1.43E-04	1.55E-05	1.49E-05	0.00E+00	1.72E-06	0.00E+00	1.39E-05	-1.26E-05
Eutrophication, terrestrial	mol N eq	1.78E-03	1.51E-03	1.69E-04	9.80E-05	0.00E+00	1.88E-05	0.00E+00	1.36E-05	-1.43E-04
Photochemical ozone formation	kg NMVOC eq	6.15E-04	5.40E-04	5.06E-05	2.41E-05	0.00E+00	5.37E-06	0.00E+00	5.81E-06	-4.45E-05
Resource use, minerals and metals	kg Sb eq	2.12E-06	2.05E-06	3.75E-08	3.28E-08	0.00E+00	3.45E-09	0.00E+00	1.41E-09	-3.48E-08
Resource use, fossils	MJ	4.02E+00	3.76E+00	1.65E-01	8.86E-02	0.00E+00	1.49E-02	0.00E+00	9.25E-03	-2.94E-01
Water use (AWARE)	m^3	9.49E-02	9.23E-02	4.92E-04	2.18E-03	0.00E+00	5.20E-05	0.00E+00	3.12E-04	-3.12E-03
Particulate matter	disease inc.	9.91E-09	8.48E-09	9.30E-10	4.95E-10	0.00E+00	8.81E-11	0.00E+00	7.36E-11	-5.97E-10
Ionizing radiation	kBq U-235 eq	1.57E-02	1.42E-02	8.46E-04	6.92E-04	0.00E+00	6.84E-05	0.00E+00	4.42E-05	-1.71E-03
Ecotoxicity, freshwater	CTUe	3.03E+00	2.78E+00	1.28E-01	1.20E-01	0.00E+00	1.28E-02	0.00E+00	2.31E-02	-2.15E-01
Human toxicity, cancer	CTUh	1.60E-09	1.59E-09	4.26E-12	7.97E-12	0.00E+00	3.80E-13	0.00E+00	5.54E-13	-1.20E-11
Human toxicity, non-cancer	CTUh	2.52E-09	2.31E-09	1.33E-10	8.44E-11	0.00E+00	1.24E-11	0.00E+00	1.95E-11	-1.23E-10
Land use	Pt	1.03E+00	5.81E-01	1.11E-01	3.43E-01	0.00E+00	1.01E-02	0.00E+00	1.92E-02	-4.17E-01
Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials	MJ	2.09E+00	1.83E+00	1.65E-01	8.71E-02	0.00E+00	1.49E-02	0.00E+00	9.25E-03	-2.94E-01
Use of non-renewable primary energy resources used as raw materials	MJ	1.93E+00	1.93E+00	0.00E+00	1.29E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use non-renew. primary energy res.	MJ	4.02E+00	3.76E+00	1.65E-01	8.84E-02	0.00E+00	1.49E-02	0.00E+00	9.25E-03	-2.94E-01
Use of renewable primary energy, excluding renewable primary energy resources used as raw materials	MJ	2.33E-01	2.43E-01	2.30E-03	-1.23E-02	0.00E+00	1.72E-04	0.00E+00	1.94E-04	-7.59E-02
Use of renewable primary energy resources used as raw materials	MJ	8.04E-02	0.00E+00	0.00E+00	8.04E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use renew. primary energy res.	MJ	3.14E-01	2.43E-01	2.30E-03	6.81E-02	0.00E+00	1.72E-04	0.00E+00	1.94E-04	-7.59E-02
Use of secondary material	kg	1.84E-02	1.84E-02	0.00E+00	4.87E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

THERMIX TX PRO T155

Impact category	Unit	Total A1-A3	A1	A2	A3	C1	C2	C3	C4	D
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	2.14E-03	2.04E-03	1.82E-05	7.95E-05	0.00E+00	1.71E-06	0.00E+00	8.20E-06	-1.18E-04
Hazardous waste disposed	kg	2.52E-06	1.94E-06	4.25E-07	1.56E-07	0.00E+00	3.94E-08	0.00E+00	1.48E-08	-1.29E-07
Non-hazardous waste disposed	kg	8.12E-02	6.96E-02	8.30E-03	3.35E-03	0.00E+00	7.58E-04	0.00E+00	3.52E-02	-9.20E-04
Radioactive waste disposed	kg	6.45E-06	5.01E-06	1.12E-06	3.21E-07	0.00E+00	9.75E-08	0.00E+00	5.34E-08	-4.78E-07
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	2.22E-02	1.15E-03	0.00E+00	2.11E-02	0.00E+00	0.00E+00	0.00E+00	1.66E-02	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ per energy carrier	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-01	0.00E+00
Climate change, neutral (IPCC 2013)	kg CO_2 eq	1.94E-01	1.77E-01	1.09E-02	6.36E-03	0.00E+00	9.96E-04	0.00E+00	6.27E-03	-1.66E-02

Table 14 - Impact assessment of 1m THERMIX TX PRO T155, Method EN 15804:2012+A2:2019.

Biogenic carbon content	Unit (kg C)
Biogenic carbon content in the product	0.00E+00
Biogenic carbon content in accompanying packaging	1.44E-03

Table 15 - Biogenic carbon content of THERMIX TX PRO T155 and its packaging.

Variants of spacer profiles

Where:
y = value of the chosen impact category, to be calculated;

x = value of the impact of the chosen baseline profile, tabulated according to the type of profile and environmental indicator;

a = multiplication factor divided by profile type, product code, and environmental indicator (Table 16, Table 17, Table 18, and Table 19).

Spacer profiles for insulating glass units are available in different widths according to customer requirements. In order to evaluate the environmental performance of profiles of specific width ranges, multiplication factors were extrapolated for use in calculating the impacts of baseline profile variants, for each impact indicator required by the EN 15804:2012+A2:2019 method [8].

For the calculation of multiplication factors, different LCA was created for each individual variant of the 4 baseline profiles analyzed, respectively, and their impact was calculated and compared to the impact of the corresponding baseline profile.

To create the variants of the baseline profiles, the compositions and weights given in the bills of materials for each profile category and product code were used.
The calculation of the LCIA impacts of the variants showed that the correlation between the mass of the variants and their respective impacts is linear: as the mass increases, the associated impact increases.
The following tables show the multiplication factors for each individual product code and impact indicator of the profile family considered.
To determine the environmental impacts associated with a given product width, the results of the baseline profiles shown in Table 8, Table 10, Table 12, and Table 14 must be multiplied by the corresponding multiplication factor as shown in the formula below. Baseline profiles correspond to a multiplication factor of 1.

$$y = x * a$$

ALUMINUM SPACER H 65

Impact categories	A055	A065	A075	A085	A095	A105	A115	A125	A135	A145	A155	A165	A175	A185	A195	A205	A215	A235	A254	A255	A265	A285
Climate change (GWP)	0.525	0.573	0.613	0.662	0.710	0.758	0.806	0.854	0.904	0.952	1	1.048	1.096	1.144	1.192	1.240	1.433	1.540	1.647	1.638	1.701	2.074
Ozone depletion	0.527	0.574	0.615	0.663	0.711	0.759	0.806	0.854	0.904	0.952	1	1.048	1.096	1.144	1.191	1.239	1.431	1.538	1.644	1.635	1.698	2.069
Acidification	0.518	0.567	0.608	0.657	0.706	0.754	0.803	0.852	0.903	0.951	1	1.049	1.097	1.146	1.195	1.244	1.439	1.548	1.656	1.647	1.710	2.088
Eutrophication, freshwater	0.522	0.570	0.611	0.660	0.708	0.756	0.805	0.853	0.904	0.952	1	1.048	1.097	1.145	1.193	1.242	1.436	1.543	1.651	1.642	1.705	2.079
Eutrophication, marine	0.527	0.574	0.615	0.663	0.711	0.759	0.806	0.854	0.904	0.952	1	1.048	1.096	1.144	1.191	1.239	1.431	1.538	1.645	1.636	1.698	2.069
Eutrophication, terrestrial	0.521	0.569	0.611	0.659	0.707	0.756	0.804	0.853	0.903	0.952	1	1.049	1.097	1.145	1.194	1.242	1.437	1.544	1.652	1.643	1.706	2.082
Photochemical ozone formation	0.520	0.569	0.610	0.659	0.707	0.755	0.804	0.852	0.903	0.952	1	1.049	1.097	1.145	1.194	1.242	1.437	1.545	1.653	1.644	1.707	2.083
Resource use, minerals and metals	0.519	0.567	0.609	0.657	0.706	0.754	0.803	0.852	0.903	0.951	1	1.049	1.097	1.146	1.195	1.243	1.439	1.547	1.656	1.646	1.710	2.087
Resource use, fossils	0.521	0.569	0.610	0.659	0.707	0.756	0.804	0.852	0.903	0.952	1	1.049	1.097	1.145	1.194	1.242	1.437	1.545	1.653	1.643	1.707	2.082
Water use (AWARE)	0.526	0.574	0.614	0.662	0.710	0.758	0.806	0.854	0.904	0.952	1	1.048	1.096	1.144	1.192	1.240	1.432	1.539	1.646	1.637	1.699	2.071
Total use renew. primary energy res.	0.576	0.618	0.655	0.698	0.741	0.784	0.826	0.869	0.914	0.957	1	1.043	1.086	1.129	1.172	1.215	1.387	1.482	1.578	1.570	1.626	1.959
Total use non-renew. primary energy res.	0.521	0.569	0.610	0.659	0.707	0.756	0.804	0.852	0.903	0.952	1	1.049	1.097	1.145	1.194	1.242	1.437	1.545	1.653	1.643	1.707	2.082
Use of secondary material	0.516	0.565	0.607	0.656	0.704	0.753	0.802	0.851	0.902	0.951	1	1.049	1.098	1.147	1.196	1.244	1.441	1.550	1.659	1.649	1.713	2.092
Use of renewable secondary fuels	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net use of fresh water	0.524	0.572	0.613	0.661	0.709	0.757	0.805	0.853	0.904	0.952	1	1.048	1.096	1.144	1.192	1.241	1.434	1.541	1.648	1.639	1.702	2.075
Hazardous waste disposed	0.515	0.564	0.606	0.655	0.704	0.753	0.802	0.851	0.902	0.951	1	1.049	1.098	1.147	1.196	1.245	1.442	1.551	1.660	1.651	1.715	2.095
Non-hazardous waste disposed	0.531	0.579	0.619	0.666	0.714	0.761	0.808	0.856	0.905	0.953	1	1.047	1.095	1.142	1.189	1.237	1.427	1.532	1.638	1.629	1.691	2.058
Radioactive waste disposed	0.527	0.575	0.616	0.663	0.711	0.759	0.807	0.854	0.905	0.952	1	1.048	1.096	1.143	1.191	1.239	1.431	1.537	1.644	1.635	1.697	2.067
Particulate matter	0.519	0.568	0.609	0.657	0.706	0.755	0.803	0.852	0.903	0.952	1	1.049	1.097	1.146	1.195	1.243	1.438	1.547	1.655	1.646	1.709	2.086
Ionising radiation	0.531	0.578	0.618	0.666	0.713	0.761	0.808	0.855	0.905	0.953	1	1.048	1.095	1.142	1.190	1.237	1.428	1.533	1.639	1.630	1.692	2.060
Ecotoxicity, freshwater	0.517	0.566	0.607	0.656	0.705	0.754	0.802	0.851	0.902	0.951	1	1.049	1.098	1.147	1.195	1.244	1.440	1.549	1.658	1.649	1.712	2.091
Human toxicity, cancer	0.520	0.569	0.610	0.658	0.707	0.755	0.804	0.852	0.903	0.952	1	1.049	1.097	1.146	1.194	1.243	1.437	1.545	1.653	1.644	1.707	2.084
Human toxicity, non-cancer	0.518	0.567	0.608	0.657	0.706	0.754	0.803	0.852	0.903	0.951	1	1.049	1.097	1.146	1.195	1.243	1.439	1.547	1.656	1.647	1.710	2.088
Land use	0.644	0.680	0.710	0.746	0.782	0.818	0.854	0.890	0.928	0.964	1	1.036	1.072	1.108	1.144	1.180	1.325	1.405	1.485	1.478	1.525	1.805
Materials for recycling	0.692	0.723	0.749	0.780	0.812	0.843	0.874	0.905	0.938	0.969	1	1.031	1.062	1.094	1.125	1.156	1.281	1.350	1.420	1.414	1.454	1.696
Materials for energy recovery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exported energy	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Climate change, neutral (IPCC 2013)	0.522	0.570	0.611	0.659	0.708	0.756	0.804	0.853	0.903	0.952	1	1.048	1.097	1.145	1.193	1.242	1.436	1.544	1.651	1.642	1.705	2.080

Table 16 - Multiplication factors for ALUMINUM SPACER H 65 variants.

CHROMATECH ULTRA F

Impact categories	U095	U105	U115	U125	U135	U145	U155	U175	U195	U215
Climate change (GWP)	0.808	0.841	0.874	0.902	0.924	0.956	1	1.041	1.121	1.212
Ozone depletion	0.773	0.816	0.858	0.889	0.912	0.952	1	1.080	1.163	1.296
Acidification	0.800	0.834	0.868	0.897	0.920	0.953	1	1.035	1.122	1.212
Eutrophication, freshwater	0.786	0.822	0.858	0.888	0.913	0.948	1	1.036	1.127	1.225
Eutrophication, marine	0.812	0.844	0.876	0.903	0.925	0.956	1	1.036	1.115	1.202
Eutrophication, terrestrial	0.803	0.836	0.869	0.898	0.921	0.953	1	1.032	1.118	1.206
Photochemical ozone formation	0.799	0.833	0.867	0.896	0.919	0.952	1	1.034	1.121	1.212
Resource use, minerals and metals	0.773	0.811	0.850	0.882	0.908	0.945	1	1.044	1.138	1.246
Resource use, fossils	0.794	0.831	0.868	0.897	0.920	0.955	1	1.056	1.139	1.247
Water use (AWARE)	0.770	0.811	0.853	0.884	0.909	0.948	1	1.067	1.154	1.277
Total use renew. primary energy res.	0.830	0.858	0.886	0.910	0.930	0.958	1	1.023	1.097	1.170
Total use non-renew. primary energy res.	0.794	0.831	0.868	0.897	0.920	0.955	1	1.056	1.139	1.247
Use of secondary material	0.757	0.792	0.826	0.862	0.894	0.928	1	0.980	1.100	1.168
Use of renewable secondary fuels	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels	-	-	-	-	-	-	-	-	-	-
Net use of fresh water	0.783	0.821	0.858	0.889	0.913	0.949	1	1.049	1.135	1.239
Hazardous waste disposed	0.807	0.842	0.876	0.904	0.925	0.958	1	1.049	1.129	1.227
Non-hazardous waste disposed	0.774	0.810	0.846	0.878	0.905	0.940	1	1.025	1.119	1.208
Radioactive waste disposed	0.788	0.825	0.861	0.891	0.915	0.950	1	1.043	1.132	1.234
Particulate matter	0.798	0.831	0.864	0.893	0.918	0.950	1	1.024	1.115	1.200
Ionising radiation	0.785	0.822	0.860	0.890	0.914	0.950	1	1.047	1.136	1.241
Ecotoxicity, freshwater	0.806	0.839	0.872	0.900	0.923	0.955	1	1.037	1.119	1.206
Human toxicity, cancer	0.774	0.807	0.840	0.873	0.903	0.936	1	0.988	1.099	1.167
Human toxicity, non-cancer	0.819	0.851	0.883	0.909	0.931	0.961	1	1.043	1.120	1.208
Land use	0.857	0.881	0.904	0.924	0.942	0.964	1	1.018	1.081	1.143
Materials for recycling	0.880	0.900	0.920	0.937	0.951	0.970	1	1.030	1.070	1.124
Materials for energy recovery	-	-	-	-	-	-	-	-	-	-
Exported energy	0.780	0.817	0.855	0.885	0.910	0.946	1	1.062	1.132	1.237
Climate change, neutral (IPCC 2013)	0.804	0.838	0.872	0.900	0.922	0.955	1	1.041	1.123	1.216

Table 17 - Multiplication factors for CHROMATECH ULTRA F variants.

MULTITECH G

Impact categories	M075	M085	M115	M125	M135	M145	M155	M175	M195	M215	M235	M265
Climate change (GWP)	0.586	0.706	0.793	0.844	0.879	0.931	1	1.085	1.171	1.258	1.344	1.498
Ozone depletion	0.554	0.575	0.591	0.600	0.607	0.616	1	1.016	1.031	1.047	1.063	1.090
Acidification	0.584	0.702	0.788	0.840	0.874	0.925	1	1.082	1.168	1.253	1.339	1.491
Eutrophication, freshwater	0.613	0.718	0.794	0.840	0.871	0.916	1	1.070	1.146	1.222	1.299	1.433
Eutrophication, marine	0.583	0.702	0.788	0.839	0.874	0.925	1	1.080	1.165	1.251	1.337	1.489
Eutrophication, terrestrial	0.589	0.707	0.792	0.842	0.877	0.927	1	1.081	1.165	1.250	1.335	1.485
Photochemical ozone formation	0.574	0.696	0.784	0.837	0.872	0.925	1	1.083	1.171	1.259	1.347	1.503
Resource use, minerals and metals	0.554	0.669	0.753	0.803	0.838	0.887	1	1.065	1.149	1.233	1.318	1.463
Resource use, fossils	0.567	0.692	0.781	0.835	0.871	0.924	1	1.088	1.177	1.267	1.356	1.516
Water use (AWARE)	0.561	0.684	0.773	0.826	0.862	0.915	1	1.082	1.171	1.260	1.349	1.506
Total use renew. primary energy res.	0.782	0.839	0.880	0.904	0.921	0.946	1	1.039	1.080	1.121	1.163	1.235
Total use non-renew. primary energy res.	0.567	0.692	0.781	0.835	0.871	0.924	1	1.088	1.177	1.267	1.356	1.516
Use of secondary material	1.000	1.000	1.000	1.000	1.000	1.000	1	1.000	1.000	1.000	1.000	1.000
Use of renewable secondary fuels	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels	-	-	-	-	-	-	-	-	-	-	-	-
Net use of fresh water	0.563	0.686	0.774	0.827	0.862	0.915	1	1.082	1.170	1.258	1.347	1.503
Hazardous waste disposed	0.661	0.743	0.803	0.839	0.863	0.899	1	1.061	1.121	1.181	1.241	1.346
Non-hazardous waste disposed	0.608	0.720	0.800	0.849	0.881	0.929	1	1.076	1.156	1.237	1.317	1.461
Radioactive waste disposed	0.634	0.735	0.808	0.851	0.881	0.925	1	1.072	1.145	1.218	1.291	1.421
Particulate matter	0.561	0.686	0.776	0.830	0.866	0.920	1	1.079	1.170	1.260	1.350	1.509
Ionising radiation	0.629	0.732	0.807	0.851	0.881	0.925	1	1.076	1.150	1.224	1.299	1.430
Ecotoxicity, freshwater	0.558	0.678	0.767	0.819	0.856	0.908	1	1.063	1.152	1.241	1.330	1.481
Human toxicity, cancer	0.546	0.646	0.727	0.773	0.809	0.854	1	0.998	1.080	1.161	1.242	1.362
Human toxicity, non-cancer	0.539	0.663	0.755	0.810	0.848	0.902	1	1.060	1.152	1.245	1.337	1.493
Land use	0.844	0.883	0.912	0.929	0.941	0.958	1	1.027	1.055	1.084	1.113	1.163
Materials for recycling	0.862	0.902	0.930	0.947	0.959	0.976	1	1.027	1.056	1.084	1.113	1.164
Materials for energy recovery	-	-	-	-	-	-	-	-	-	-	-	-
Exported energy	0.550	0.680	0.773	0.829	0.866	0.922	1	1.090	1.183	1.276	1.369	1.536
Climate change, neutral (IPCC 2013)	0.580	0.702	0.790	0.842	0.877	0.929	1	1.086	1.174	1.261	1.349	1.504

Table 18 - Multiplication factors for MULTITECH G variants.

THERMIX TX PRO

Impact categories	T075	T085	T095	T115	T125	T135	T145	T155	T175	T195	T215	T235
Climate change (GWP)	0.657	0.685	0.853	0.908	0.941	0.955	0.986	1	1.081	1.127	1.162	1.210
Ozone depletion	0.766	0.785	0.909	0.947	0.970	0.980	1.001	1	1.074	1.108	1.126	1.161
Acidification	0.609	0.637	0.852	0.907	0.938	0.953	0.985	1	1.086	1.133	1.164	1.213
Eutrophication, freshwater	0.583	0.609	0.859	0.909	0.938	0.955	0.984	1	1.089	1.138	1.159	1.207
Eutrophication, marine	0.638	0.666	0.852	0.906	0.938	0.953	0.984	1	1.083	1.130	1.160	1.209
Eutrophication, terrestrial	0.620	0.648	0.849	0.904	0.936	0.952	0.984	1	1.087	1.135	1.166	1.216
Photochemical ozone formation	0.614	0.646	0.832	0.894	0.930	0.946	0.981	1	1.089	1.140	1.178	1.232
Resource use, minerals and metals	0.431	0.456	0.863	0.913	0.941	0.955	0.982	1	1.079	1.124	1.145	1.190
Resource use, fossils	0.665	0.703	0.801	0.876	0.923	0.936	0.979	1	1.088	1.144	1.201	1.263
Water use (AWARE)	0.619	0.653	0.818	0.887	0.928	0.942	0.980	1	1.090	1.144	1.187	1.245
Total use renew. primary energy res.	0.614	0.633	0.897	0.933	0.953	0.966	0.988	1	1.067	1.103	1.118	1.154
Total use non-renew. primary energy res.	0.665	0.703	0.801	0.876	0.923	0.936	0.979	1	1.088	1.144	1.201	1.263
Use of secondary material	0.629	0.665	0.795	0.867	0.902	0.933	0.968	1	1.147	1.223	1.228	1.299
Use of renewable secondary fuels	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels	-	-	-	-	-	-	-	-	-	-	-	-
Net use of fresh water	0.615	0.645	0.839	0.899	0.934	0.949	0.982	1	1.091	1.142	1.174	1.227
Hazardous waste disposed	0.711	0.733	0.895	0.937	0.961	0.973	0.996	1	1.078	1.115	1.135	1.173
Non-hazardous waste disposed	0.501	0.530	0.841	0.898	0.930	0.947	0.978	1	1.090	1.141	1.165	1.217
Radioactive waste disposed	0.668	0.696	0.848	0.905	0.938	0.954	0.985	1	1.093	1.143	1.170	1.222
Particulate matter	0.542	0.571	0.837	0.896	0.930	0.946	0.979	1	1.088	1.139	1.170	1.223
Ionising radiation	0.675	0.703	0.856	0.910	0.941	0.957	0.987	1	1.092	1.140	1.165	1.215
Ecotoxicity, freshwater	0.513	0.536	0.872	0.917	0.942	0.959	0.984	1	1.084	1.129	1.145	1.189
Human toxicity, cancer	0.413	0.436	0.868	0.914	0.937	0.957	0.980	1	1.094	1.144	1.148	1.194
Human toxicity, non-cancer	0.507	0.533	0.858	0.909	0.938	0.954	0.982	1	1.087	1.134	1.154	1.202
Land use	0.694	0.713	0.896	0.932	0.952	0.965	0.987	1	1.063	1.098	1.116	1.151
Materials for recycling	0.838	0.856	0.902	0.938	0.959	0.967	0.987	1	1.046	1.074	1.096	1.127
Materials for energy recovery	-	-	-	-	-	-	-	-	-	-	-	-
Exported energy	0.638	0.679	0.777	0.859	0.907	0.925	0.970	1	1.102	1.166	1.218	1.287
Climate change, neutral (IPCC 2013)	0.650	0.679	0.850	0.907	0.940	0.954	0.986	1	1.083	1.129	1.164	1.214

Table 19 - Multiplication factors for THERMIX TX PRO variants.

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