

Ty-Rap® cable ties

PEP ecopassport®

Product Environmental Profile



Registration number:	ABBG-00611-V02.01-EN	Drafting rules:	PCR-ed4-EN-2021 09 06
PEP Owner:	Oscar Sarmiento Penuela - oscar.sarmiento-penuela@ch.abb.com	Supplemented by:	PSR-0003-ed2-EN-2023 06 06
Verifier accreditation number:	VH44	Information and reference documents:	www.pep-ecopassport.org
Date of issue:	04/2024	Validity period:	5 years
Independent verification of the declaration and data in compliance with ISO 14025: 2006			
Internal:	☐	External:	☒
The PCR review was conducted by a panel of experts chaired by Julie Orgelet (Ddomain)			
PEPs are compliant with XP C08-100-1:2016 and EN 50693:2019 or NF E38-500 :2022 The components of the present PEP may not be compared with components from any other program.			
Document complies with ISO 14025:2006 "Environmental labels and declarations. Type III environmental declarations"			
			



ABB Purpose & Embedding Sustainability

ABB is committed to continually promoting and embedding sustainability across its operations and value chain, aspiring to become a role model for others to follow. With its ABB Purpose, ABB is focusing on reducing harmful emissions, preserving natural resources and championing ethical and humane behavior. The context of this PEP cannot be compared with the content based on another program/database.

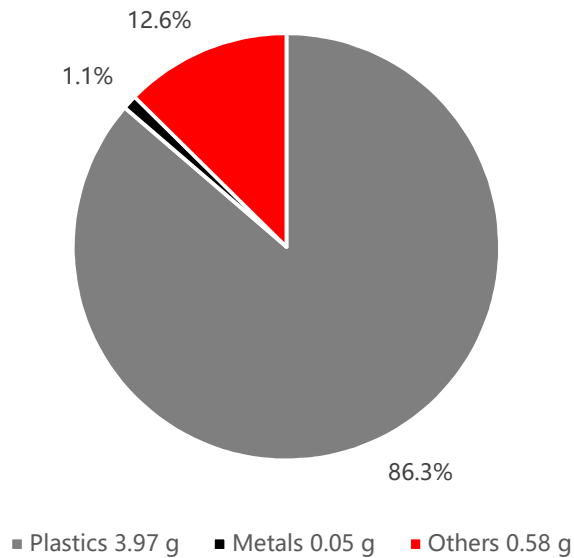


General information

Reference product	Product TY27MX
Description of the product	Ty-Raps® are cable ties characterized by a corrosion-resistant, non-magnetic stainless-steel locking barb in its head grips tightly and allows for a completely adjustable fit. Moreover, its raised tail makes it easy to pick up, even with gloved hand, and its easy-grip tail surface makes it easy to pull tight, even in wet or cold conditions.
Functional unit	The function unit is to mount a cable or a tube at a point with a cable tie with a clamping capacity between 1.5 mm and 229 mm for a reference lifetime of 20 years. The reference product is one piece of TY27MX cable tie with a weight of 4.043 g and its packaging of 0.5804 g.
Other products covered	List of other products covered in this PEP is presented in the paragraph which concerned the extrapolation rules
Manufacturing address	Cabo Caribe Industrial Park Lot 32-34 Vega Baja PR 00693



Constituent Materials



Total weight of reference product and packaging

4.6

g

Plastics as % of weight		Metals as % of weight		Others as % of weight	
Name and CAS number	Weight%	Name and CAS number	Weight%	Name and CAS number	Weight%
Nylon	86.3	Steel	1.1	Cardboard	8.1
				Wood	4.0
				Low density polyethylene	0.5
				Label	<0.1
Plastics Total %	86.3	Metals Total %	1.1	Others Total %	12.6

Total weight of the reference product 4.043 g plus packaging 0.5804 g



Additional Information

Manufacturing	The manufacturing stage includes the production and transportation to the manufacturer's last logistic platform of Ty-Rap® cable ties and its packaging. The final assembly of the product is carried out at ABB's plant located in Vega Baja (PR)
Distribution	The transport from ABB PR factory to storages (Byhalia, Mississippi and Phoenix, Arizona) sites were taken into account. For the distribution of the product from storages to the final customer, secondary data for the distance has been used for lorry and a weighted average has been computed relative to distances with a cut-off about 10%.
Installation	No installation materials are required in the life cycle of the product. During this phase there is the disposal of the excess cable tie cut and the packaging.
Use	No material and energy consumption occur during the use stage. No maintenance happens during the use phase, the environmental impacts linked to this procedure have been considered equal to zero in the respective results section.
End of life	The default end-of-life scenario provided by the PCR document has been adopted for the Ty-Rap® cable ties (100% incineration).
Benefits and loads beyond the system boundaries	No benefits and loads beyond the system boundaries has been considered.



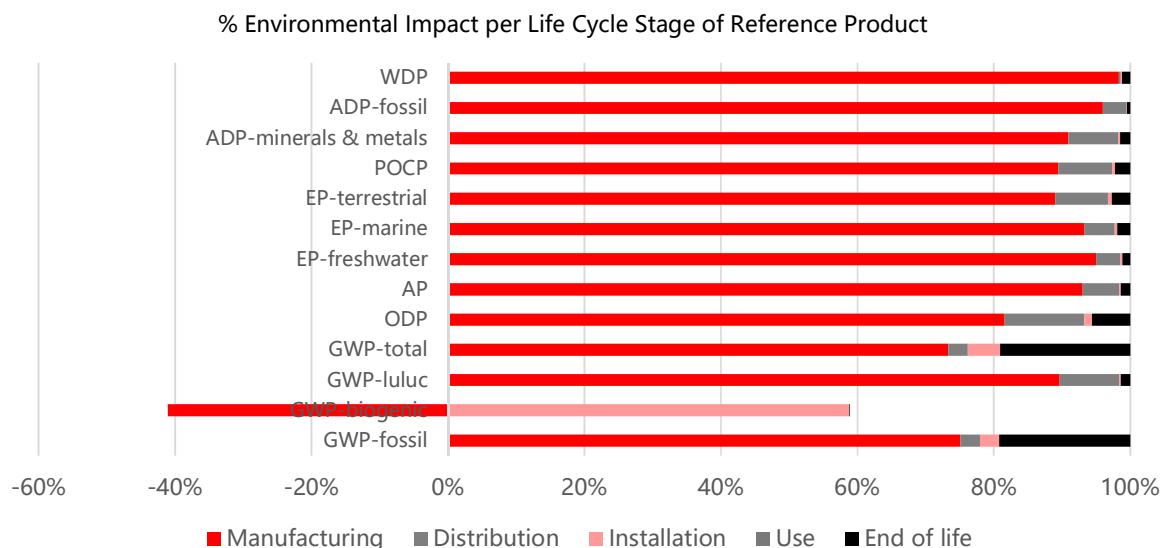
Environmental Impacts

Reference lifetime	20 years
Product category	Category: Other Cable Management Products Sub-category: Electrical installation mounting systems
Installation elements	No installation materials are required in the life cycle of the product. During this phase there is the disposal of the excess cable tie cut
Use scenario	No material and energy consumption occur during the use stage. No maintenance phase is planned for the the Ty-Rap® cable ties.
Temporal representativeness	The temporal coverage for each secondary process used in the LCA model is specified in the metadata section of the ecoinvent database. Secondary data refers to the ecoinvent database v3.9.1 published in 2022.
Geographical representativeness	Global
Technological representativeness	Technological representativeness refers to the specific production process for primary data.
Software and database used	SimaPro 9.5 and ecoinvent 3.9.1

Energy model used

Manufacturing	The energy-related processes used for the inputs of the manufacturing stage is an ad-hoc process which considers 100% hydroelectric energy Netherlands as reported in the RECs.
Installation	No energy consumption occur during the installation stage. The energy-related processes used for the inputs of the end-of-life stage are those included in ecoinvent 3.9.1
Use	No energy consumption occur during the use stage.
End of life	The energy-related processes used for the inputs of the end-of-life stage are those included in ecoinvent 3.9.1

Common base of mandatory indicators



Environmental impact indicators based on functional unit

Indicator	Unit	Total*	Manufacturing	Distribution	Installation	Use	End of life	Benefits & Loads
GWP-Total	kg CO2 eq.	4.41E-02	3.24E-02	1.25E-03	2.09E-03	0.00E+00	8.43E-03	-
GWP-Fossil	kg CO2 eq.	4.39E-02	3.30E-02	1.25E-03	1.24E-03	0.00E+00	8.43E-03	-
GWO-Biogenic	kg CO2 eq.	2.59E-04	-5.97E-04	3.85E-07	8.54E-04	0.00E+00	1.35E-06	-
GWP-Luluc	kg CO2 eq.	7.53E-06	6.75E-06	6.59E-07	1.90E-08	0.00E+00	1.04E-07	-
ODP	kg CFC-11 eq.	1.75E-10	1.42E-10	2.04E-11	1.91E-12	0.00E+00	9.83E-12	-
AP	H+ eq.	1.65E-04	1.53E-04	8.82E-06	4.49E-07	0.00E+00	2.25E-06	-
EP-Freshwater	kg P eq.	2.70E-06	2.56E-06	9.54E-08	7.11E-09	0.00E+00	3.19E-08	-
EP-Marine	kg N eq.	6.32E-05	5.90E-05	2.78E-06	2.40E-07	0.00E+00	1.21E-06	-
EP-Terrestrial	mol N eq.	3.88E-04	3.45E-04	3.00E-05	2.12E-06	0.00E+00	1.06E-05	-
POCP	kg NMVOC eq.	1.25E-04	1.12E-04	9.84E-06	5.52E-07	0.00E+00	2.79E-06	-
ADP-Minerals & Metals	kg SB eq.	4.32E-08	3.93E-08	3.17E-09	1.19E-10	0.00E+00	6.51E-10	-
ADP-Fossil	MJ	5.21E-01	5.00E-01	1.80E-02	4.80E-04	0.00E+00	2.64E-03	-
WDP	m³ eq. depr.	3.17E-02	3.12E-02	8.70E-05	6.29E-05	0.00E+00	3.81E-04	-

Resource use indicators

Indicator	Unit	Total*	Manufacturing	Distribution	Installation	Use	End of life	Benefits & Loads
PERE	MJ	1.12E-01	1.12E-01	2.19E-04	1.48E-05	0.00E+00	7.73E-05	-
PERM	MJ	1.02E-02	1.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-
PERT	MJ	1.22E-01	1.22E-01	2.19E-04	1.48E-05	0.00E+00	7.73E-05	-
PENRE	MJ	3.77E-01	3.56E-01	1.80E-02	4.80E-04	0.00E+00	2.64E-03	-
PENRM	MJ	1.45E-01	1.45E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-
PENRT	MJ	5.21E-01	5.00E-01	1.80E-02	4.80E-04	0.00E+00	2.64E-03	-

*Total not including Benefits and Loads

Common base of mandatory indicators

Use of secondary materials, water, and energy resources

Indicator	Unit	Total*	Manufacturing	Distribution	Installation	Use	End of life	Benefits & Loads
SM	kg	1.15E-03	1.15E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-
FW	m³	7.47E-04	7.30E-04	2.74E-06	2.06E-06	0.00E+00	1.21E-05	-

Waste category indicators

Indicator	Unit	Total*	Manufacturing	Distribution	Installation	Use	End of life	Benefits & Loads
HWD	kg	5.75E-07	4.44E-07	1.11E-07	2.90E-09	0.00E+00	1.64E-08	-
N-HWD	kg	3.67E-03	2.00E-03	1.43E-03	3.99E-05	0.00E+00	2.06E-04	-
RWD	kg	4.10E-08	3.60E-08	3.75E-09	1.93E-10	0.00E+00	1.01E-09	-

Output flow indicators

Indicator	Unit	Total*	Manufacturing	Distribution	Installation	Use	End of life	Benefits & Loads
CfRu	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-
MfR	kg	4.73E-03	4.73E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-
MfER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-
EE	MJ	6.32E-02	4.51E-03	0.00E+00	1.08E-02	0.00E+00	4.80E-02	-

Other indicators

Indicator	Unit	Total*	Manufacturing	Distribution	Installation	Use	End of life	Benefits & Loads
Biogenic Carbon - Product	kg of C	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-
Biogenic Carbon - Packaging	kg of C	3.35E-04	3.35E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-

Optional indicators

Indicator	Unit	Total*	Manufacturing	Distribution	Installation	Use	End of life	Benefits & Loads
Tot PE	MJ	6.44E-01	6.22E-01	1.82E-02	4.95E-04	0.00E+00	2.72E-03	-
Efp	Dise inc	1.69E-09	1.55E-09	1.19E-10	3.41E-12	0.00E+00	1.60E-11	-
IrHH	kBq U-235 eq	1.69E-04	1.49E-04	1.58E-05	7.70E-07	0.00E+00	4.02E-06	-
ETX FW	CTUe	9.54E-02	6.57E-02	9.48E-03	3.02E-03	0.00E+00	1.71E-02	-
HTX CE	CTUh	5.99E-11	5.85E-11	5.43E-13	1.47E-13	0.00E+00	7.65E-13	-
HTX N-CE	CTUh	1.32E-10	8.81E-11	1.24E-11	5.34E-12	0.00E+00	2.65E-11	-
IrLS	Pt	1.76E-01	1.58E-01	1.67E-02	1.91E-04	0.00E+00	1.12E-03	-

*Total not including Benefits and Loads

Approach for extrapolation rules applied to a homogeneous environmental family

The PEP can cover products belonging to a homogeneous environmental family, even though they differ from the reference product. Therefore, the group of products must satisfy the following characteristics:

- same function;
- same product standard;
- similar manufacturing technology: the same type of materials and same manufacturing processes.

The product family satisfies these conditions, so extrapolation rules are applied following the PCR guidelines to assess the environmental impact of the products belonging to the family. The extrapolation rules are defined by the following steps:

- Analyse the products covered by the PEP belonging to the same homogenous family;
- Perform the LCA of a representative product of the homogeneous family;
- Identify and quantify the product parameters that vary between the various products of the homogeneous environmental family (i.e. dimensions, the weight of parts, materials, energy consumption, etc.).

Lastly, a sensitivity analysis was performed for each life cycle stage to identify which parameters of the ones selected are sensitive to environmental impacts to create extrapolation rules.

The parameters identified are listed below:

- product net weight;
- packaging weight related to one product.

The representative product considered for the calculation of the extrapolation rules is

- TY27MX

This product is most representative for the sales.

The results of the sensitivity analysis show that all the parameters considered are sensitive.

The products included in the product family and considered for the application of the extrapolation rules are presented in the following table.

Variable Weights

SKU	Product Net Weight (g)	Packaging Weight (g)	Product Net weight (g) + packaging weight (g)
TY5442PX	21.493	2.3222914	23.8152914
TY5460PX	29.464	2.3222914	31.7862914
TY53418PX	10.897	1.6322914	12.5292914
TY5418PX	10.897	1.6322914	12.5292914
TY5424PX	13.522	1.6322914	15.1542914
TY5409	12.365	1.6322914	13.9972914
TY409	12.881	3.7738	16.6548
TY546MF	95.67	3.454	99.124
TY545MX	3.124	1.4022914	4.5262914
TY5275M	5.15	1.4022914	6.5522914
TY275M	5.15	1.5683914	6.7183914
TY275M-5	5.15	1.5683914	6.7183914
TY275MX-RW	5.15	1.5683914	6.7183914
TY37MX	6.04	1.5683914	7.6083914
TY275MX	6.7829864	1.5683914	8.3513778
TY5275MX	6.783	1.7753914	8.5583914
TY5277M	7.181	1.7753914	8.9563914
TY5277MX	7.181	1.7753914	8.9563914
TY277M	7.181	1.5683914	8.7493914
TY277M-2	7.181	1.5683914	8.7493914
TY277M-4	7.181	1.5683914	8.7493914
TY277M-5	7.181	1.5683914	8.7493914
TY277MX	7.181	1.5683914	8.7493914
TY277MX-RW	7.181	1.5683914	8.7493914
TY29MX-50	9.219	2.753183673	11.97218367
TY529MX	9.219	1.759075073	10.97807507
TY529M	9.219	1.759075073	10.97807507
TY29M	9.219	2.546183673	11.76518367
TY29M-10	9.219	2.546183673	11.76518367
TY29M-2	9.219	2.546183673	11.76518367
TY29M-4	9.219	2.546183673	11.76518367
TY29MX	9.219	2.546183673	11.76518367
TY537M	6.04	1.4022914	7.4422914
TY537MX	6.04	1.4022914	7.4422914
TY541M	3.67	1.4022914	5.0722914
TY546MT	94.44	2.311857143	96.75185714
TY27MX-50	4.043	2.3964	6.4394
TY527MX	4.043	1.4022914	5.4452914
TY27M-50	4.043	2.3964	6.4394
TY527M	4.043	1.4022914	5.4452914
TY41M	3.67	2.16275	5.83275
TY538M	1.564	2.1748	3.7388

Variable Weights Continued

TY5272M	3.002	2.2898	5.2918
TY5272MX	3.002	2.2898	5.2918
TY546MD	47.817	2.2898	50.1068
TY5532M	0.461	0.207117427	0.668117427
TY5253M	0.484	0.207117427	0.691117427
TY5253M-2	0.484	0.207117427	0.691117427
TY5253MX	0.484	0.207117427	0.691117427
TY5253MXR-RW	0.484	0.207117427	0.691117427
TY5512M	0.677	0.207117427	0.884117427
TY5234M	0.733	0.207117427	0.940117427
TY5234MX	0.733	0.207117427	0.940117427
TYR508	1.839	2.116061224	3.955061224
TY5354M	2.405	2.116061224	4.521061224
TY5354MX	2.405	2.116061224	4.521061224
TY548M	2.587	2.116061224	4.703061224
TY46MX	1.202	0.103536778	1.305536778
TY38M	1.564	0.103536778	1.667536778
TY38MX	1.564	0.103536778	1.667536778
TY27M-1	4.043	0.5804457	4.6234457
TY27M-2	4.043	0.5804457	4.6234457
TY27M-3	4.043	0.5804457	4.6234457
TY27M-4	4.043	0.5804457	4.6234457
TY27M-5	4.043	0.5804457	4.6234457
TY27M-6	4.043	0.5804457	4.6234457
TY27M-7	4.043	0.5804457	4.6234457
TY27M-8	4.043	0.5804457	4.6234457
TY27M	4.043	0.5804457	4.6234457
TY46MD	47.817	0.5804457	48.3974457
TY46MD-3	47.817	0.5804457	48.3974457
TY46MD-5	47.817	0.5804457	48.3974457
TY46MDX	47.817	0.5804457	48.3974457
TY46MT	94.44	0.5804457	95.0204457
TY46MF	95.67	0.6034457	96.2734457
TY526M	1.438	1.0607664	2.4987664
TY526MX	1.452	2.054875	3.506875
TY528MX	2.468	1.0607664	3.5287664
TY528M	2.468	1.0607664	3.5287664
TY48M	2.587	0.195734854	2.782734854
TY48M-2	2.587	0.195734854	2.782734854
TY48M-5	2.587	0.195734854	2.782734854
TY48MX	2.587	0.195734854	2.782734854
TY272M	3.002	0.5804457	3.5824457
TY272M-1	3.002	0.5804457	3.5824457
TY272M-2	3.002	0.5804457	3.5824457

Variable Weights Continued

TY272M-4	3.002	0.5804457	3.5824457
TY272M-5	3.002	0.5804457	3.5824457
TY272M-6	3.002	0.5804457	3.5824457
TY272M-9	3.002	0.5804457	3.5824457
TY272MX	3.002	0.5804457	3.5824457
TY27MX	4.043	0.5804457	4.6234457
TY253M	0.484	0.103617427	0.587617427
TY253M-0	0.484	0.103617427	0.587617427
TY253M-2	0.484	0.103617427	0.587617427
TY253M-5	0.484	0.103617427	0.587617427
TY253M-6	0.484	0.103617427	0.587617427
TY253M-8	0.484	0.103617427	0.587617427
TY253MX	0.484	0.103617427	0.587617427
TY525M-10	1.504	1.6449	3.1489
TY525M-2	1.504	1.6449	3.1489
TY535M	1.745	1.6449	3.3899
TY535M-8	1.745	1.6449	3.3899
TY535MX	1.745	1.6449	3.3899
TY1435M	1.745	0.195734854	1.940734854
TY35M	1.745	0.195734854	1.940734854
TY35MX	1.745	0.195734854	1.940734854
TY635MX	1.745	0.195734854	1.940734854
TY354M	2.405	0.195734854	2.600734854
TY354MX	2.405	0.195734854	2.600734854
TY28M-1	2.468	0.195734854	2.663734854
TY28M-10	2.468	0.195734854	2.663734854
TY28M-2	2.468	0.195734854	2.663734854
TY28M-3	2.468	0.195734854	2.663734854
TY28M-4	2.468	0.195734854	2.663734854
TY28M-5	2.468	0.195734854	2.663734854
TY28M-6	2.468	0.195734854	2.663734854
TY28M-7	2.468	0.195734854	2.663734854
TY28M-8	2.468	0.195734854	2.663734854
TY28MX-RW	2.468	0.195734854	2.663734854
TY28M	2.468	0.195734854	2.663734854
TY546M	23.9085	1.521566667	25.43006667
TY551M	0.386	0.207117427	0.593117427
TY52315M	0.412	0.207117427	0.619117427
TY52315MX	0.412	0.207117427	0.619117427
TY5232M	0.461	1.362930736	1.823930736
TY5232MX	0.461	1.362930736	1.823930736
TY553M	0.484	1.362930736	1.846930736
TY534M	0.733	1.362930736	2.095930736
TY534MX	0.733	0.195734854	0.928734854

Variable Weights Continued

TY5242M	0.9	1.362930736	2.262930736
TY5242MX	0.9	1.362930736	2.262930736
TY554M	1.344	1.0607664	2.4047664
TYR505	1.54	0.299234854	1.839234854
TY28MX-100	2.468	1.484666667	3.952666667
TY28M-100	2.468	1.484666667	3.952666667
TY28MX	2.468	0.195734854	2.663734854
TY525MX	1.504	1.590428571	3.094428571
TY525M	1.504	0.593374271	2.097374271
TY533M	0.304	0.207117427	0.511117427
TY533MX	0.304	0.207117427	0.511117427
TY242M	0.9	0.092403661	0.992403661
TY242M-2	0.9	0.092403661	0.992403661
TY242M-3	0.9	0.092403661	0.992403661
TY242M-4	0.9	0.092403661	0.992403661
TY242M-5	0.9	0.092403661	0.992403661
TY242M-6	0.9	0.092403661	0.992403661
TY242M-8	0.9	0.092403661	0.992403661
TY242M-9	0.9	0.092403661	0.992403661
TY242MX	0.9	0.092403661	0.992403661
TY46M	1.202	0.103617427	1.305617427
TY46M-4	1.202	0.103617427	1.305617427
TY46M-6	1.202	0.103617427	1.305617427
TY26M-2	1.438	0.103617427	1.541617427
TY26M-3	1.438	0.103617427	1.541617427
TY26M-4	1.438	0.103617427	1.541617427
TY26M-5	1.438	0.103617427	1.541617427
TY26M-6	1.438	0.103617427	1.541617427
TY26M-8	1.438	0.103617427	1.541617427
TY26MX-RW	1.438	0.103617427	1.541617427
TY26M	1.438	0.103617427	1.541617427
TY25M-0	1.504	0.103617427	1.607617427
TY25M-1	1.504	0.103617427	1.607617427
TY25M-10	1.504	0.103617427	1.607617427
TY25M-2	1.504	0.103617427	1.607617427
TY25M-3	1.504	0.103617427	1.607617427
TY25M-4	1.504	0.103617427	1.607617427
TY25M-5	1.504	0.103617427	1.607617427
TY25M-6	1.504	0.103617427	1.607617427
TY25M-7	1.504	0.103617427	1.607617427
TY25M-8	1.504	0.103617427	1.607617427
TY25MX-RW	1.504	0.103617427	1.607617427
TY25M	1.504	0.103617427	1.607617427
TY26M-100	1.438	1.39225	2.83025

Variable Weights Continued

TY26MX-100	1.452	1.39225	2.84425
TY25MX-100	1.504	1.39225	2.89625
TY25M-100	1.504	1.39225	2.89625
TY51M	0.386	0.5804457	0.9664457
TY51M-3	0.386	0.5804457	0.9664457
TY51M-4	0.386	0.5804457	0.9664457
TY532M	0.461	0.103617427	0.564617427
TY153M	0.484	0.5804457	1.0644457
TY153M-3	0.484	0.5804457	1.0644457
TY53M	0.484	0.5804457	1.0644457
TY53MX	0.484	0.5804457	1.0644457
TY512M	0.675	0.103617427	0.778617427
TY512M-2	0.675	0.103617427	0.778617427
TY234M	0.733	0.103617427	0.836617427
TY234M-2	0.733	0.103617427	0.836617427
TY234M-4	0.733	0.103617427	0.836617427
TY234M-6	0.733	0.103617427	0.836617427
TY234MX	0.733	0.103617427	0.836617427
TY234MX-RW	0.733	0.103617427	0.836617427
TY34M	0.733	0.103617427	0.836617427
TY34MX	0.733	0.103617427	0.836617427
TY24MX-100	0.581	1.31447619	1.89547619
TY524M	0.581	1.300632035	1.881632035
TY524MX	0.581	1.300632035	1.881632035
TY24M-100	1.007	1.299833333	2.306833333
TY26MX	1.452	0.103617427	1.555617427
TY25MX	1.504	0.103617427	1.607617427
TY23M-100	0.227	0.207117427	0.434117427
TY23MX-100	0.227	0.207117427	0.434117427
TY523M	0.227	0.207117427	0.434117427
TY523MX	0.227	0.207117427	0.434117427
TY23M	0.227	0.103617427	0.330617427
TY23M-0	0.227	0.103617427	0.330617427
TY23M-1	0.227	0.103617427	0.330617427
TY23M-10	0.227	0.103617427	0.330617427
TY23M-2	0.227	0.103617427	0.330617427
TY23M-3	0.227	0.103617427	0.330617427
TY23M-4	0.227	0.103617427	0.330617427
TY23M-5	0.227	0.103617427	0.330617427
TY23M-6	0.227	0.103617427	0.330617427
TY23M-7	0.227	0.103617427	0.330617427
TY23M-8	0.227	0.103617427	0.330617427
TY23MX	0.227	0.103617427	0.330617427
TY23MX-RW	0.227	0.103617427	0.330617427

Variable Weights Continued

TY33M	0.304	0.103617427	0.407617427
TY33MX	0.304	0.103617427	0.407617427
TYB2315M	0.412	0.103617427	0.515617427
TYB2315MX	0.412	0.103617427	0.515617427
TY232M	0.461	0.103617427	0.564617427
TY232M-1	0.461	0.103617427	0.564617427
TY232M-2	0.461	0.103617427	0.564617427
TY232M-3	0.461	0.103617427	0.564617427
TY232M-4	0.461	0.103617427	0.564617427
TY232M-5	0.461	0.103617427	0.564617427
TY232M-6	0.461	0.103617427	0.564617427
TY232M-8	0.461	0.103617427	0.564617427
TY232M-9	0.461	0.103617427	0.564617427
TY232MX	0.461	0.103617427	0.564617427
TY232MX-RW	0.461	0.103617427	0.564617427
TY24M-0	0.581	0.103617427	0.684617427
TY24M-1	0.581	0.103617427	0.684617427
TY24M-10	0.581	0.103617427	0.684617427
TY24M-2	0.581	0.103617427	0.684617427
TY24M-3	0.581	0.103617427	0.684617427
TY24M-4	0.581	0.103617427	0.684617427
TY24M-5	0.581	0.103617427	0.684617427
TY24M-6	0.581	0.103617427	0.684617427
TY24M-7	0.581	0.103617427	0.684617427
TY24M-8	0.581	0.103617427	0.684617427
TY24MX	0.581	0.103617427	0.684617427
TY24M	1.007	0.092403661	1.099403661
TY54M	1.344	0.103617427	1.447617427

Extrapolation Rules

The extrapolation rules are calculated based on the LCIA results of all the 20 products (reference product + variants), and the sensitivity analysis carried out for the extrapolation rules.

The influential parameters for calculating the LCIA impacts of the variants are product net weight and packaging weight related to one product for the installation and distribution stages. For the manufacturing and end of life stages, the influential parameter is product net weight.

A linear correlation between the LCIA impacts of the representative product and its variants is identified using these parameters. The most suitable equation is determined by considering the SimaPro impact results and the weights of several variables. To derive the best-fit equation, data were processed using Excel. Each environmental indicator value is calculated using the following formulas:

- Manufacturing Stage:

$$y = ax_1 + b$$

x_1 = Product net weight (g)

- Distribution Stage:

$$y = ax_1 + b$$

x_1 = Product net weight (kg) + Packaging weight(kg)

- Installation Stage:

$$y = ax_1 + b$$

x_1 = Product net weight (kg) + Packaging weight(kg)

- End-of-Life Stage:

$$y = ax_1 + b$$

x_1 = Product net weight (kg)

The table above can be referenced for the components' weights and all their variants. The coefficients' calculation for the use stage is not performed because this stage is not present in the Life cycle of the product and so there aren't impacts related to this phase.

The following tables report the linear coefficients (a, b) for each life cycle stage.

Extrapolation Factors

MANUFACTURING STAGE

Impact category indicator	a	b
GWP-total	8.59E-03	1.22E-03
GWP-fossil	8.80E-03	1.30E-03
GWP-biogenic	-2.10E-04	-7.57E-05
GWP-luluc	1.60E-06	1.35E-06
ODP	3.54E-11	9.12E-12
AP	4.07E-05	5.99E-06
EP-freshwater	6.63E-07	1.85E-07
EP-marine	1.57E-05	2.14E-06
EP-terrestrial	9.09E-05	1.24E-05
POCP	2.94E-05	4.00E-06
ADP-minerals & metals	9.27E-09	2.72E-09
ADP-fossil	1.35E-01	2.00E-02
WDP	8.46E-03	1.26E-03
Efp	4.12E-10	7.65E-11
IrHH	3.79E-05	2.07E-05
ETX FW	1.70E-02	3.08E-03
HTX CE	1.44E-11	6.69E-13
HTX N-CE	2.19E-11	7.06E-12
IrLS	4.86E-02	7.02E-03
PERE	2.83E-02	1.16E-03
PERM	3.14E-03	1.15E-03
PERT	3.14E-02	2.32E-03
PENRE	9.72E-02	1.74E-02
PENRM	3.73E-02	2.59E-03
PENRT	1.35E-01	2.00E-02
SM	2.37E-04	-6.06E-05
RSF	0.00E+00	0.00E+00
NRSF	0.00E+00	0.00E+00
FW	1.98E-04	2.96E-05
HWD	1.12E-07	1.60E-08
N-HWD	4.79E-04	1.30E-04
RWD	9.22E-09	4.98E-09
CfRU	0.00E+00	0.00E+00
MFR	1.19E-03	7.33E-05
MfER	0.00E+00	0.00E+00
EE	1.12E-03	-1.47E-08

Extrapolation Factors

DISTRIBUTION STAGE		
Impact category indicator	a	b
GWP-total	2.70E-04	-2.40E-07
GWP-fossil	2.70E-04	-2.40E-07
GWP-biogenic	8.33E-08	-7.39E-11
GWP-luluc	1.42E-07	-1.26E-10
ODP	4.42E-12	-3.92E-15
AP	1.91E-06	-1.69E-09
EP-freshwater	2.06E-08	-1.83E-11
EP-marine	6.01E-07	-5.33E-10
EP-terrestrial	6.50E-06	-5.77E-09
POCP	2.13E-06	-1.89E-09
ADP-minerals & metals	6.85E-10	-6.08E-13
ADP-fossil	3.89E-03	-3.45E-06
WDP	1.88E-05	-1.67E-08
Efp	2.57E-11	-2.28E-14
IrHH	3.42E-06	-3.03E-09
ETX FW	2.05E-03	-1.82E-06
HTX CE	1.17E-13	-1.04E-16
HTX N-CE	2.68E-12	-2.38E-15
IrLS	3.61E-03	-3.21E-06
PERE	4.73E-05	-4.20E-08
PERM	0.00E+00	0.00E+00
PERT	4.73E-05	-4.20E-08
PENRE	3.89E-03	-3.45E-06
PENRM	0.00E+00	0.00E+00
PENRT	3.89E-03	-3.45E-06
SM	0.00E+00	0.00E+00
RSF	0.00E+00	0.00E+00
NRSF	0.00E+00	0.00E+00
FW	5.93E-07	-5.27E-10
HWD	2.41E-08	-2.14E-11
N-HWD	3.09E-04	-2.75E-07
RWD	8.11E-10	-7.20E-13
CfRU	0.00E+00	0.00E+00
MFR	0.00E+00	0.00E+00
MfER	0.00E+00	0.00E+00
EE	0.00E+00	0.00E+00

Extrapolation Factors

INSTALLTION STAGE		
Impact category indicator	a	b
GWP-total	5.46E-04	8.76E-05
GWP-fossil	3.07E-04	2.72E-05
GWP-biogenic	2.39E-04	6.04E-05
GWP-luluc	4.81E-09	1.28E-09
ODP	4.34E-13	1.50E-13
AP	1.11E-07	2.46E-08
EP-freshwater	1.94E-09	-2.86E-11
EP-marine	5.82E-08	1.20E-08
EP-terrestrial	5.25E-07	1.03E-07
POCP	1.38E-07	2.76E-08
ADP-minerals & metals	3.02E-11	7.77E-12
ADP-fossil	1.25E-04	2.83E-05
WDP	1.26E-05	4.97E-06
Efp	9.01E-13	1.91E-13
IrHH	1.84E-07	5.46E-08
ETX FW	6.45E-04	1.99E-04
HTX CE	3.44E-14	7.74E-15
HTX N-CE	1.27E-12	2.64E-13
IrLS	5.16E-05	1.23E-05
PERE	3.50E-06	9.94E-07
PERM	0.00E+00	0.00E+00
PERT	3.50E-06	9.94E-07
PENRE	1.25E-04	2.83E-05
PENRM	0.00E+00	0.00E+00
PENRT	1.25E-04	2.83E-05
SM	0.00E+00	0.00E+00
RSF	0.00E+00	0.00E+00
NRSF	0.00E+00	0.00E+00
FW	4.21E-07	1.57E-07
HWD	7.89E-10	1.77E-10
N-HWD	9.95E-06	2.46E-06
RWD	4.59E-11	1.38E-11
CfRU	0.00E+00	0.00E+00
MFR	0.00E+00	0.00E+00
MfER	0.00E+00	0.00E+00
EE	2.79E-03	4.49E-04

Extrapolation Factors

END-OF-LIFE STAGE		
Impact category indicator	a	b
GWP-total	2.09E-03	-2.68E-05
GWP-fossil	2.09E-03	-2.69E-05
GWP-biogenic	2.53E-07	1.09E-07
GWP-luluc	2.58E-08	-5.03E-11
ODP	2.44E-12	-2.58E-14
AP	5.57E-07	-5.62E-09
EP-freshwater	7.83E-09	3.17E-11
EP-marine	3.01E-07	-3.32E-09
EP-terrestrial	2.63E-06	-2.80E-08
POCP	6.92E-07	-6.80E-09
ADP-minerals & metals	1.61E-10	-1.04E-12
ADP-fossil	6.53E-04	-3.34E-06
WDP	9.47E-05	-1.32E-06
Efp	3.95E-12	-8.07E-15
IrHH	9.96E-07	-8.08E-09
ETX FW	4.25E-03	-5.06E-05
HTX CE	1.90E-13	-2.07E-15
HTX N-CE	6.57E-12	-8.18E-14
IrLS	2.77E-04	5.99E-07
PERE	1.91E-05	-1.71E-07
PERM	0.00E+00	0.00E+00
PERT	1.91E-05	-1.71E-07
PENRE	6.53E-04	-3.34E-06
PENRM	0.00E+00	0.00E+00
PENRT	6.53E-04	-3.34E-06
SM	0.00E+00	0.00E+00
RSF	0.00E+00	0.00E+00
NRSF	0.00E+00	0.00E+00
FW	3.01E-06	-4.10E-08
HWD	4.06E-09	-2.12E-11
N-HWD	5.10E-05	-4.04E-07
RWD	2.49E-10	-2.07E-12
CfRU	0.00E+00	0.00E+00
MFR	0.00E+00	0.00E+00
MfER	0.00E+00	0.00E+00
EE	1.19E-02	-1.55E-04

Comparability

EPDs published within the same product category, though originating from different programs, may not be comparable. Full conformance with a PCR allows PEP comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible.

Applicable product standards

Product technical and Certification specifications can be found in the product catalogue on ABB's website.

Glossary

Environmental impact Indicators

GWP-total	Global Warming Potential total (Climate change)
GWP-fossil	Global Warming Potential fossil
GWP-biogenic	Global Warming Potential biogenic
GWP-luluc	Global Warming Potential land use and land use change
ODP	Depletion potential of the stratospheric ozone layer
AP	Acidification potential
EP-freshwater	Eutrophication potential - freshwater compartment
EP-marine	Eutrophication potential - fraction of nutrients reaching marine end compartment
EP-terrestrial	Eutrophication potential - Accumulated Exceedance
POCP	Tropospheric ozone creation potential
ADP-m&m	Abiotic Depletion for non-fossil resources potential
ADP-fossil	Abiotic Depletion for fossil resources potential
WDP	Water deprivation potential

Resource indicators

PENRE	Use of non-renewable primary energy excluding renewable primary energy resources used as raw material
PENRM	Use of non-renewable primary energy resources used as raw material
PENRT	Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)
PERE	Use of renewable primary energy excluding non-renewable primary energy resources used as raw material.
PERM	Use of renewable primary energy resources used as raw material
PERT	Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)

Secondary materials, water and energy resources		Waste category indicators	
SM	Use of secondary materials	HWD	Hazardous waste disposed
RSF	Use of renewable secondary fuels	N-HWD	Non-hazardous waste disposed
NRSF	Use of non-renewable secondary fuels	RWD	Radioactive waste disposed
FW	Net use of fresh water		
Output flow indicators		Optional indicators	
CfRu	Components for re-use	Tot PE	Total use of primary energy during the life cycle
MfR	Materials for recycling	Efp	Emissions of Fine particles
MfER	Materials for energy recovery	IrHH	Ionizing radiation, human health
EE	Exported Energy	ETX FW	Ecotoxicity, freshwater
		HTX CE	Human toxicity, carcinogenic effects
		HTX N-CE	Human toxicity, non-carcinogenic effects
		IrLS	Impact related to Land use / soil quality

References

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- [3] EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems
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- [5] ISO 14044:2006 - Environmental management - Life cycle assessment - Requirements and guidelines
- [6] ecoinvent v3.9.1 (2022). ecoinvent database version 3.9.1 - (<https://ecoinvent.org/>)
- [7] SimaPro Software version 9.5 (2023) - PRé Sustainability
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