Environmental Product Declaration

of multiple products, based on a representative product, in accordance with ISO 14025 and EN 15804:2012+A2:2019/AC:2021 for:

AXMK - Power cable 0,6/1 kV with Al conductors, XLPE insulated and PVC sheathed from TT kabeli d.o.o.

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-0018145
Publication date:	2025-01-27
Valid until:	2030-01-27

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

v 1.0

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2019:14 CONSTRUCTION PRODUCTS*, version 1.3.4, UN CPC code 46 - Electrical machinery and apparatus, 4634 - Other electric conductors, for a voltage not exceeding 1000 V*
PCR review was conducted by: The Technical Committee of the International EPD® System. Chair: Claudia Peña. Contact via info@environdec.com
Life Cycle Assessment (LCA) LCA practitioner: Davor Ljubas, Ctt-Center of Technology Transfer, Zagreb, Croatia
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: - *Jaka Jelenc, EPD Lead verifier* - *Camilla Landén* *In case of accredited certification bodies:* Accredited by: *Bureau Veritas Certification Sverige AB accredited by SWEDAC with accreditation number 1236.* *In case of recognised individual verifiers:* Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ 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 characterization 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: TT kabeli d.o.o., Knešpolje bb, 88220, Široki Brijeg, Bosnia and Herzegovina
Contact: Eugen Šušak, deputy general director
Description of the organisation: The main subject of business of the company TT kabeli d.o.o. is the production of a wide spectra of cables. TT kabeli d.o.o. is the leading manufacturer of cables for different purposes in the region.

The company TT kabeli d.o.o. was founded in 2007. The company headquarters is located in Široki Brijeg, Knešpolje bb, Bosnia and Herzegovina, as well as the cable production facility. With its quality and partnership-oriented relations, TT kabeli d.o.o. was quickly becoming the leading brand in the production of cable products in the region.

Product-related or management system-related certifications: ISO 9001, ISO 14001, ISO 45001, ISO 50001
Name and location of production site(s): Knešpolje bb, 88220, Široki Brijeg, Bosnia and Herzegovina

More information: About products – https://www.ttcables.com/
LCA practitioner: Davor Ljubas
Contact information of the organisation carrying out the underlying LCA study: CTT - Center of Technology Transfer llc, Ivana Lučića 5, 10000 Zagreb, CROATIA
Additional information: Acknowledging the growing body of evidence of environmental pollution and the major impact on Earth's climate change, TT kabeli d.o.o. has begun the process of establishing its environmental impacts related to the production of cables. As a suitable first step in determining the impact on the environment, the creation of a Life Cycle Assessment (LCA) Study was initiated in 2023.

LCA is a standardized methodology for assessing the potential environmental impacts of products, services and organizations using a life cycle perspective. This LCA study was conducted in accordance with the standards and guidelines [1-5].

Product information

Product name: AXMK (additional names - NA2XY, ARG16R16, ARG16OR16, EA2XY, U-1000 AR2V, YMvK Al, AL/XLPE/PVC)
Product identification: Power cable 0,6/1 kV with Al conductors, XLPE insulated and PVC sheathed
Product description: AXMK cables are applied in earth, ducts, on support brackets, in dry and wet conditions etc., where one does not expect mechanical damages and the cables are not exposed to the mechanical tensile strain. In urban networks, industrial plants, electric power plants and other electricity consumers and for connection of control devices in industry, traffic etc.

AXMK consists of the following series of cable products in 2022:

- AXMK 1x240 RM
- AXMK 1x300 RM
- AXMK 4x120 SM
- AXMK 4x150 SM
- AXMK 4x16 RE
- AXMK 4x185 SM
- AXMK 4x240 SM
- AXMK 4x25 RM

- AXMK 4x35 RM
- AXMK 4x50 SM
- AXMK 4x70 SM
- AXMK 4x95 SM
- AXMK 5x120 RM
- AXMK 5x16 RE
- AXMK 5x25 RM
- AXMK 5x35 SM
- AXMK 5x70 SM
- AXMK 5x95 SM

As the representative product in this group of cables AXMK, following cable was chosen to represent the whole AXMK group:

- AXMK 4x240, produced quantity – more then 10 km

As the representative cable for the whole group the cable AXMK, the cable 4x240 was chosen according to the suggestions in [6,7] by the highest share in the production quantities by mass within the cables in the group in 2022.

The choice of specific cables is justified by following instructions given in GPI 4.0 [7] and in PCR [4] with the following statement – since in the group of the products there is variation in impact indicator results below 10%, if the EPD does not claim compliance with ISO 21930, variations above 10% are allowed. Therefore this EPD covers all the products in the AXMK product group.

UN CPC code: 46, 4634

Products are produced in one site: Knešpolje bb, 88220, Široki Brijeg, Bosnia and Herzegovina

Electricity use in the production process was modelled by the data from the Ecoinvent database under **Electricity, medium voltage, residual mix BA (based on statistics from AIB-2023).**

LCA information

Functional unit: 1 m of underground power cable
Reference service life: min. 30 years
Time representativeness: reference year 2022
Database(s) and LCA software used: The assessment of the possible environmental impacts of the TT kabeli d.o.o.'s products was carried out with the support of the software **OpenLCA version 2.3** & **Ecoinvent** database **version v3.10**, using the EN 15804 + A2 Method **EF 3.1** and Cumulative Energy Demand (**CED**) for impact assessment.

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.

Transport of raw materials for production purposes is mostly brought by road vehicles (trucks). The average transport distances for raw materials supplies is given in following table:

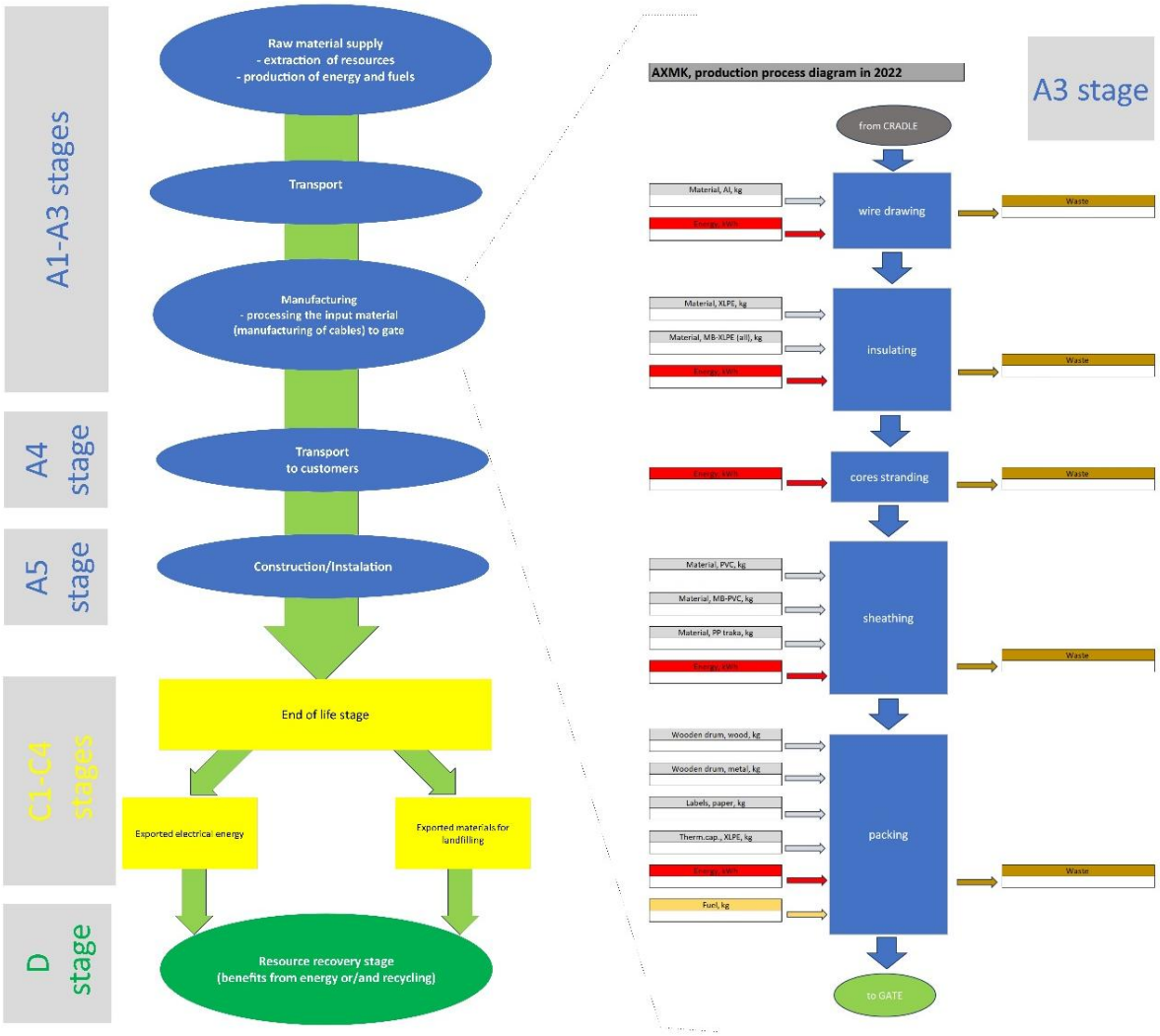
State	Supplied materials	Average distance to Široki Brijeg, km
Austria	3	848
Bosnia and Herzegovina	2	167
Croatia	1	493
France	1	1245
Hungary	1	688
Scotland	1	2781
Germany	1	1196
Turkey	1	1349
UAE	1	7154
Bahrain	1	7750
Romania	1	970

The following steps are not included in the study:

- maintenance and operation of support equipment;
- transport to warehouse and to final customer;
- product use.

It is assumed that by end-of-life stage (C1-C4) 60% of polymer material will be incinerated for electric energy and aluminium wire will be recycled with the rate of 90%. In C1 stage manual disassembly without operations relevant to LCA is assumed. Transport distance to the incineration plant was assumed to be 100 km. In C4 stage 40% of polymer material goes to landfilling. Wooden drums after installation (A5) will be incinerated for electric energy.
Module D comprises energetic recovery potentials resulting from end-of-life recycling.

Description of the system boundaries: *Cradle to gate (A1–A3) with modules End of life (C1-C4), module D and optional modules A4-A5.*



System diagram: (left – system boundaries, right – insight into the production process, i.e. “gate to gate”, A3 stage

Modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation: (***X*** – included, ***ND*** – Not declared)

	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***	***X***	***X***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***X***	***X***	***X***	***X***	***X***
Geography	GLO	EU	BA	EU	EU								EU	EU	EU	EU	EU
Specific data used	<20%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	>10%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not relevant					-	-	-	-	-	-	-	-	-	-	-	-

Even though the environmental impacts are divied in LCA stages, we are discouraging the use of the results of modules A1-A3 (A1-A5 for services) without considering the results of module C.

The EPD framework includes a 3-step allocation procedure, but system expansion according to the ISO14044 is not allowed in the EPD due to the nature of the framework being strictly attributional, not consequential.
The 3-step allocation procedure:

- When possible, allocation shall be avoided through sub-dividing the processes, so that the input and output data related to the sub-processes can be obtained.
- When allocation cannot be avoided, a partitioning of input and output to different products or services shall be done based on their underlying physical relationship.
- If allocation based on a physical relationship cannot be applied, partitioning based on another relationship is also possible. A sensitivity analysis needs to be performed when economic value is used as a basis for allocation.

By-products of waste treatment processes are cut-off, as are all by-products classified as recyclable.
Markets in this model include all activities in proportion to their current production volume.
The general rules for cut-off of inputs and outputs follow the requirements in EN 15804, 6.3.5, where the total of neglected input flows per module shall be a maximum of 5 % of energy usage and mass and 1 % of energy usage and mass for unit processes.

Content information

Table 1. Basic information about product components and packaging materials per functional unit

Product components	Weight, kg/m	Post-consumer material, weight-%	Biogenic material, weight-%
	AXMK 4x240		
Material, Al, kg	2.48E+00	0%	0%
Material, XLPE, kg	4.35E-01	0%	0%
Material, MB-XLPE (colour), kg	4.39E-03	0%	0%
Material, PVC, kg	6.91E-01	0%	0%
Material, MB-PVC (colour), kg	1.04E-02	0%	0%
TOTAL	3.62E+00	0%	0%
Packaging materials	**Weight, kg/m**	**Weight-% (versus the product)**	
	AXMK 4x240		
Wooden drum, wood, kg	9.03E-01	25%	
Wooden drum, metal, kg	8.06E-02	2.23%	
Labels, paper, kg	1.00E-05	0.001%	
Thermal cap., XLPE, kg	1.55E-04	0.02%	
TOTAL	9.84E-01	27%	

.

The product does not contain any REACH SVHC substances.

Environmental Information

Potential environmental impact – mandatory indicators according to EN 15804

Table 2. Potential environmental impact aggregated for A1-A3, C1-C4 and D modules per functional unit

Indicator	Unit	Total A1-A3	A4	A5	C1	C2	C3	C4	D
AXMK 4x240									
GWP-fossil	kg CO_2 eq.	3.58E+01	1.67E+00	3.98E-01	0.00E+00	6.87E-02	1.69E+00	3.98E-02	-2.59E+01
GWP-biogenic	kg CO_2 eq.	-3.89E-02	2.74E-04	3.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP-luluc	kg CO_2 eq.	3.55E+01	1.67E+00	3.57E-01	0.00E+00	6.87E-02	1.69E+00	3.97E-02	-2.56E+01
GWP-total	kg CO_2 eq.	3.13E-01	5.53E-04	1.76E-03	0.00E+00	2.28E-05	9.08E-05	2.87E-06	-2.52E-01
ODP	kg CFC 11 eq.	1.15E-06	3.31E-08	3.65E-09	0.00E+00	1.37E-09	4.22E-09	1.31E-10	-4.13E-07
AP	mol H^+ eq.	1.91E-01	3.47E-03	2.04E-03	0.00E+00	1.43E-04	7.49E-04	3.67E-05	-1.27E-01
EP-freshwater	kg P eq	1.10E-02	1.13E-04	1.90E-04	0.00E+00	4.65E-06	4.18E-05	5.44E-07	-6.92E-03
EP-marine	kg N eq.	2.92E-02	8.34E-04	8.81E-04	0.00E+00	3.44E-05	2.43E-04	1.54E-04	-1.83E-02
EP-terrestrial	mol N eq.	2.95E-01	9.00E-03	6.58E-03	0.00E+00	3.71E-04	2.30E-03	1.49E-04	-1.82E-01
POCP	kg NMVOC eq.	1.30E-01	5.77E-03	2.67E-03	0.00E+00	2.38E-04	7.01E-04	5.99E-05	-8.21E-02
ADP-minerals&metals*	kg Sb eq.	9.17E-05	5.55E-06	1.02E-06	0.00E+00	2.29E-07	1.06E-06	1.19E-08	-3.83E-05
ADP-fossil*	MJ	5.30E+02	2.34E+01	4.73E+00	0.00E+00	9.66E-01	1.51E+00	1.13E-01	-3.32E+02
WDP*	m^3	2.68E+01	1.15E-01	2.58E-01	0.00E+00	4.72E-03	1.11E+00	5.53E-04	-2.07E+01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; 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, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption								

** 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 (according to [3], Table 5).*

Potential environmental impact – additional mandatory and voluntary indicators

Table 3. Additional mandatory and voluntary indicators per functional unit

Indicator	Unit	Tot. A1-A3	A4	A5	C1	C2	C3	C4	D
AXMK 4x240									
GWP-GHG[1]	kg CO_2 eq.	3.57E+01	1.67E+00	3.59E-01	0.00E+00	6.86E-02	1.69E+00	3.98E-02	-2.64E+01
Additional voluntary indicators e.g. the voluntary indicators from EN 15804 or the global indicators according to ISO 21930:2017 -N.D.									

Use of resources

Table 4. Energy indicators per functional unit

Indicator	Unit	Tot. A1-A3	A4	A5	C1	C2	C3	C4	D
AXMK 4x240									
PERE	MJ	1.33E+02	3.72E-01	1.87E+01	0.00E+00	1.73E+01	1.22E-01	1.56E-03	-9.84E+01
PERM	MJ	0.00E+00	0.00E+00	1.53E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.33E+02	3.72E-01	3.40E+01	0.00E+00	1.73E+01	1.22E-01	1.56E-03	-9.84E+01
PENRE	MJ	5.26E+02	2.31E+01	2.29E+00	0.00E+00	2.12E+00	1.49E+00	1.11E-01	-3.89E+02
PENRM	MJ.	1.08E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E+02	0.00E+00	-7.99E+01
PENRT	MJ	6.34E+02	2.31E+01	2.29E+00	0.00E+00	2.12E+00	1.10E+02	1.11E-01	-4.69E+02
SM	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
RSF	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
NRSF	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
FW	m^3	1.68E+02	3.89E-01	7.21E-01	0.00E+00	1.60E-02	1.21E-01	1.55E-03	-1.24E+02

[1] The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

Waste production and output flows

Waste production

Table 5. Waste production per functional unit

Results per functional unit for AXMK 4x240									
Indicator	**Unit**	**Tot. A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	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
Non-hazardous waste disposed	kg	7.07E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.50E-01	0.00E+00
Radioactive waste disposed	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

Output flows

Table 6. Output flows per functional unit

Results per functional unit									
Indicator	**Unit**	**Tot. A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
AXMK 4x240									
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
Material for recycling	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
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.90281	0.00E+00	0.00E+00	0.675362	0.00E+00	0.00E+00
Exported energy, electricity	MJ	ND	ND	ND	ND	ND	ND	ND	ND
Exported energy, thermal	MJ	ND	ND	ND	ND	ND	ND	ND	ND

Information on biogenic carbon content

Table 7. Biogenic carbon content in product and in packaging per functional unit

Results per functional or functional unit		
BIOGENIC CARBON CONTENT	**Unit**	**QUANTITY**
AXMK 4x240		
Biogenic carbon content in product	kg C	0.0
Biogenic carbon content in packaging	kg C	1.06E-02

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2.

Additional information

-

Information related to Sector EPD

-

Differences versus previous versions

This version v.1.0 is the first version of EPD calculation for the products of the Group A for TT kabeli d.o.o. company.

.

References

[1] HRN EN ISO 14040:2008 - *Upravljanje okolišem – Procjena životnog ciklusa (LCA) – Načela i okvir rada* (ISO 14040:2006; EN ISO 14040:2006), Hrvatski zavod za norme, Zagreb, 2018.

[2] HRN EN ISO 14044:2008 - *Upravljanje okolišem – Procjena životnog ciklusa (LCA) – Zahtjevi i smjernice* (ISO 14044:2006; EN ISO 14044:2006), Hrvatski zavod za norme, Zagreb, 2020.

[3] HRN EN 15804:2019 - *Održivost građevina – Izjava zaštite okoliša – Osnovna pravila za kategorizaciju građevnih proizvoda* (EN 15804:2012+A2:2019 + EN 15804:2012 + A2:2019/AC:2021), Hrvatski zavod za norme, Zagreb, 2021.

[4] Product Category Rules (PCR) – CONSTRUCTION PRODUCTS, PCR 2019:14, v.1.3.4, EPD International AB, 2022.

[5] Product Category Rules PCR 2019:14-c-PCR-019 Electrical cables and wires (for construction sector) (c-PCR to PCR 2019:14) (Adopted from EPD Norway)

[6] Ljubas, D., *LCA (Life Cycle Assessment) study for AXMK, AXMK-PE and NFA2X product groups of the company TT Kabeli d.o.o. in accordance with ISO 14040 and ISO 14044 standards*, CTT-Center of Technology Transfer, Zagreb, V1.3, December 2024.

[7] EPD International AB, *General programme instructions for the international EPD system* **v. 4.0**., 2021-03-29

EPD®

www.environdec.com