Type III Environmental Product Declaration No. 362/2022

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V-suspension string for twin conductor bundle- V16/21 Duplex

Owner of the EPD:

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ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804+A2 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment and their aspects verified by the independent body according to ISO 14025. Basically, comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804+A2.

Life cycle analysis (LCA): A1-A3, C1-C4 and D modules in accordance with EN 15804
(Cradle-to-Gate with options)

The year of preparing the EPD: 2022

Product standard: EN 61109

Service Life: 40 years

PCR: ITB-PCR A

Declared unit: 1 item

Reasons for performing LCA: B2B

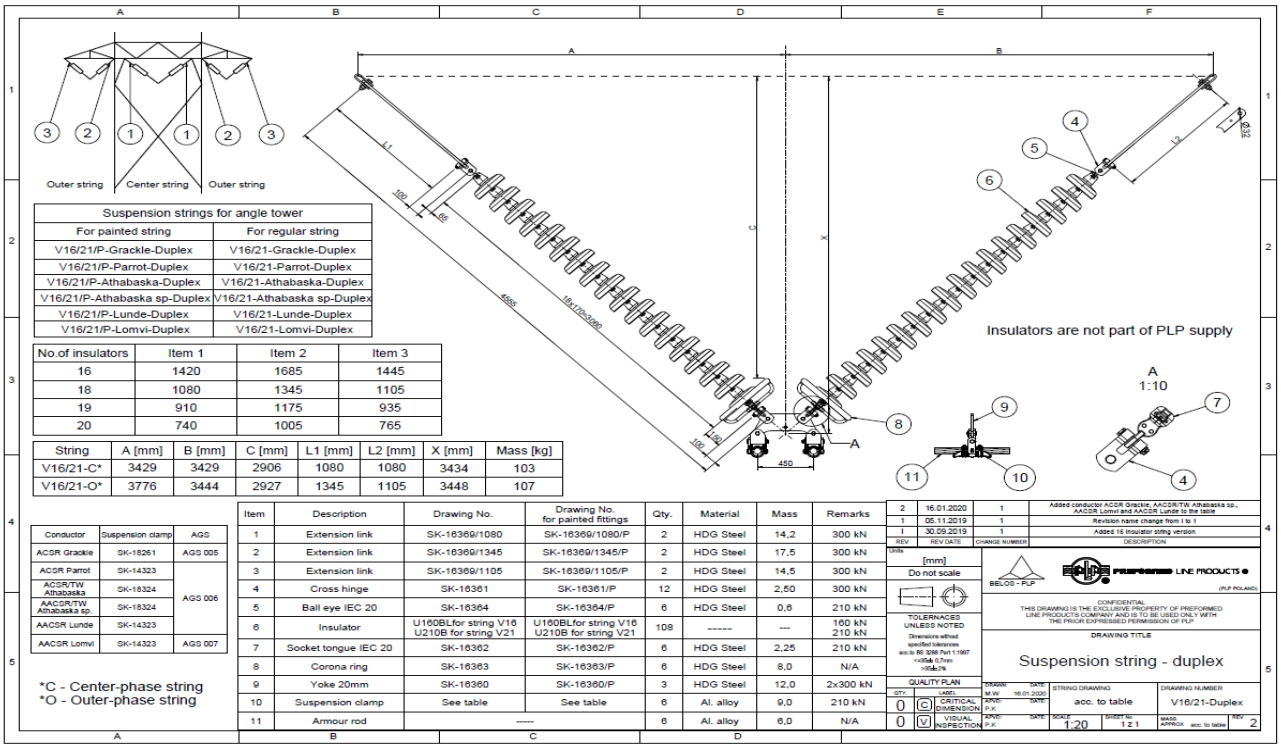
Representativeness: Polish, European, 2021

MANUFACTURER

BELOS-PLP S.A. is the largest Polish producer of network equipment for HV, MV, LV and LV lines of power stations, operating in the power industry since 1947. Belos-PLP maintains close cooperation with market-leading design offices and research institutes, thanks to which our products meet the required standards. In 2007, after the entry of a strategic investor, the company became part of the Preformed Line Products (PLP) group - a global manufacturer and supplier of products, technologies and solutions for energy and telecommunications. Preformed Line Products (PLP) based in Cleveland, Ohio, listed on the NASDAQ: PLPC was founded in 1947. It is currently an international group that supplies its products to customers all over the world. The environmental declaration covers the product -suspension string for twin conductor bundle - V16 / 21 Duplex (excluding insulators) used in high voltage networks. The product is manufactured at the Bielsko-Biala plant in Poland.

PRODUCTS DESCRIPTION AND APPLICATION

The products covered by this EPD is insulator string for high voltage transmission lines made of HDG steel elements (hot dip galvanized Z/Zn acc PN-EN ISO 1461) with aluminium alloy elements. Suspension insulators string made by BELOS (calaolg number V16/21-Duplex) is used as a part of transmission lines in power networks being the installation which helps transmit power over long distances. Conductor which transmits power is connected in between towers using insulator strings.Mass of the product is 110 kg (metal parts only without insulators), max height is 3488 mm and max width is 7220 mm. More detailed technical information can be fount at manufacturer [web site](#).



Suspension strings for angle tower	
For painted string	For regular string
V16/21/P-Grackle-Duplex	V16/21-Grackle-Duplex
V16/21/P-Parrot-Duplex	V16/21-Parrot-Duplex
V16/21/P-Athabaska-Duplex	V16/21-Athabaska-Duplex
V16/21/P-Athabaska sp-Duplex	V16/21-Athabaska sp-Duplex
V16/21/P-Lunde-Duplex	V16/21-Lunde-Duplex
V16/21/P-Lomvi-Duplex	V16/21-Lomvi-Duplex

No.of insulators	Item 1	Item 2	Item 3
16	1420	1685	1445
18	1080	1345	1105
19	910	1175	935
20	740	1005	765

String	A [mm]	B [mm]	C [mm]	L1 [mm]	L2 [mm]	X [mm]	Mass [kg]
V16/21-C*	3429	3429	2906	1080	1080	3434	103
V16/21-O*	3776	3444	2927	1345	1105	3448	107

Conductor	Suspension clamp	AGS
ACSR Grackle	SK-18261	AGS 005
ACSR Parrot	SK-14323	AGS 006
ACSR/TW Athabaska	SK-18324	
AACSR/TW Athabaska sp.	SK-18324	
AACSR Lunde	SK-14323	
AACSR Lomvi	SK-14323	AGS 007

Item	Description	Drawing No.	Drawing No. for painted fittings	Qty.	Material	Mass	Remarks
1	Extension link	SK-16369/1080	SK-16369/1080/P	2	HDG Steel	14,2	300 kN
2	Extension link	SK-16369/1345	SK-16369/1345/P	2	HDG Steel	17,5	300 kN
3	Extension link	SK-16369/1105	SK-16369/1105/P	2	HDG Steel	14,5	300 kN
4	Cross hinge	SK-16361	SK-16361/P	12	HDG Steel	2,50	300 kN
5	Ball eye IEC 20	SK-16364	SK-16364/P	6	HDG Steel	0,6	210 kN
6	Insulator	U160BLfor string V16 U210B for string V21	U160BLfor string V16 U210B for string V21	108	------	---	160 kN 210 kN
7	Socket tongue IEC 20	SK-16362	SK-16362/P	6	HDG Steel	2,25	210 kN
8	Corona ring	SK-16363	SK-16363/P	6	HDG Steel	8,0	N/A
9	Yoke 20mm	SK-16360	SK-16360/P	3	HDG Steel	12,0	2x300 kN
10	Suspension clamp	See table	See table	6	Al. alloy	9,0	210 kN
11	Armour rod	-----		6	Al. alloy	6,0	N/A

Fig 1. Basic technical information on V16/21-Duplex product

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is one muliti-element product made of HDG steel (110 kg)

System boundary

The life cycle analysis of the declared products covers “Product Stage” A1-A3, C1-C4+D modules in accordance with EN 15804 and ITB PCR A (cradle to gate with options). Energy and water consumption, emissions as well as information on generated wastes were inventoried and were included in the calculation. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804+A2, machines and facilities (capital goods) required for the production as well as transportation of employees were not included in LCA.

Allocation

The allocation rules used for this EPD are based on general ITB’s document PCR A. Production of the covered steel products is a line process (as presented in figure 2) conducted in the manufacturing plant located in Bielsko-Biała (Poland). Input and output data from the production is inventoried and allocated to the production on the mass basis.

System limits

Minimum 99.0% input materials and 100% energy consumption (electricity, gas, heat, LPG) were inventoried in a processing plant and were included in the calculation. In the assessment, all significant parameters from gathered production data are considered, i.e. all material used per formulation, utilized thermal energy, and electric power consumption, direct production waste and available emission measurements. Tires consumption for transport was not considered. Substances with a percentage share of less than 0.1% of total mass were excluded from the calculations. The packaging products (wooden pallets and boxes) are included.

Modules A1 and A2: *Raw materials supply and transport*

The modules A1 and A2 represent the extraction and processing of raw materials (mainly steel provided by European producers) and transport to the production site. Steel used come from the suppliers producing steel with 50% EAF technology and 50% BOF. For A2 module (transport) European averages for fuel data are applied. All transport of input resources is inventored in details.

Module A3: *Production*

The product specific manufacturing process line is presented in Figure 1, an input steel/semi-product is processed (mechanical and thermal treatment) to a dedicated shape and elements are galvanized and assembled. Electricity and gas are consumed in the process.

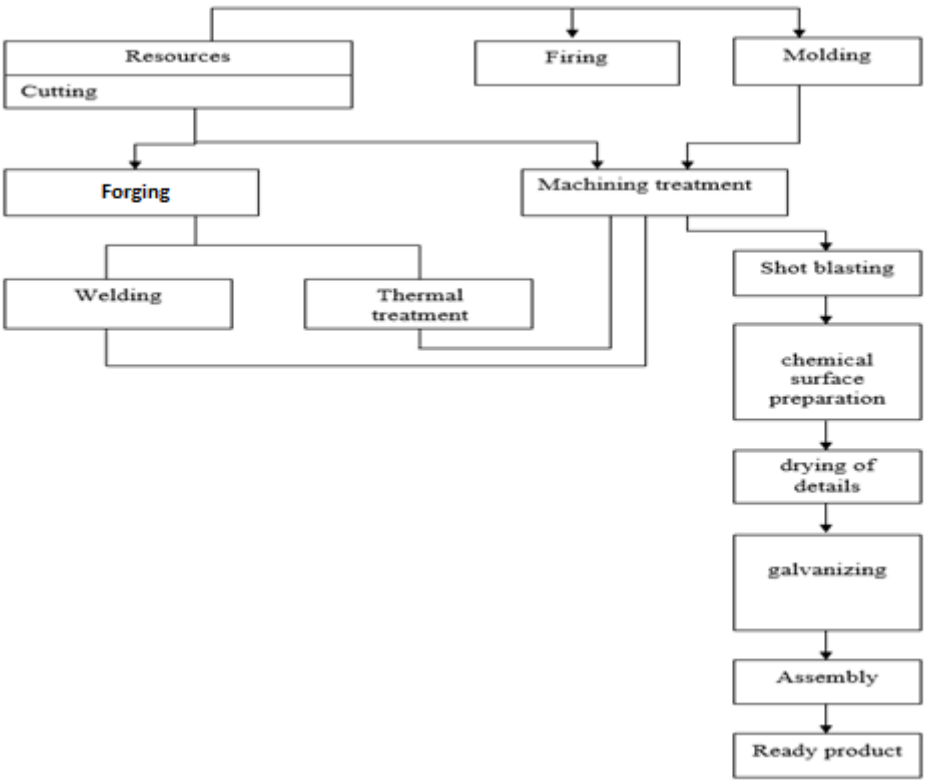


Fig. 2. A basic scheme of the product manufacturing process

Modules *C2-C4 and D: End-of-life (EOL)*

The amount of energy for disassembly in C1 module by electric mechanical tool was generalized based on actual practice. In the adapted end-of-life scenario, the de-constructed steel products are transported to a steel mill distant by 110 km on > 16t lorry EURO 5 where are used as steel scrap to produce a new steel. The recycling potential of C3 module is 98% and it is assumed that only 2% of the products will end up in a landfill – C4 module (table 1). Module D presents credits resulting from the recycling of the steel scrap, calculated in accordance with the is the net amount of scrap approach developed by World Steel Association.

Table 1. End-of-life scenario for the steel products

Material	Material recovery	Recycling	Landfilling
Steel scrap	100%	98%	2%

Electricity at end-of-life (module C) has been modelled using an average Polish electricity mix as the location where the product reaches end-of-life is unknown.

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2021 – 31.12.2021 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Data quality

The data selected for LCA originate from ITB-LCI questionnaires completed by BELOS using the inventory data, ITB and Ecoinvent v.3.8 database. No specific data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency are judged as good. The background data for the processes come from

the following databases: Ecoinvent v.3.8 (steel unalloyed and alloyed, cast steel, welding wire, bolts, nuts (mechanical processing), galvanization process, zinc alloy, grease, wooden packaging, low alloy construction steel, water, waste water treatment) and KOBIZE (Polish electricity mix and combustion factors for fuels). KOBIZE data is supplemented with Ecoinvent data on the national electricity mix impact where no specific indicator data is provided. Specific (LCI) data quality analysis was a part of the input data verification. The time related quality of the data used is valid (5 years).

Assumptions and estimates

Possible differences resulting from the production of very specific compositions of steel alloys were were taken into account where possible. If not used data for high and low alloy steels produced in BOF and EAF furnaces in Europe (European average).

Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN15804+A2. Emission of greenhouse gases was calculated using the IPCC 2013 GWP method with a 100-year horizon. Emission of acidifying substances, Emission of substances to water contributing to oxygen depletion, Emission of gases that contribute to the creation of ground-level ozone, Abiotic depletion, and ozone depletion emissions where all calculated with the CML-IA baseline method

Additional information

Polish electricity mix used is 0.698 kg CO_2/kWh (KOBiZE 2021).

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 piece of suspension string for twin conductor bundle-V16/21 Duplex produced by BELOS. The environmental impacts of the life cycle are shown in Tables 3-6.

Table 2. System boundaries for the environmental characteristic of the V16/21 Duplex

Environmental assessment information (MD – Module Declared, MND – Module Not Declared, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse-recovery-recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
MD	**MD**	**MD**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MD**	**MD**	**MD**	**MD**	**MD**

Table 3. Life cycle assessment (LCA) results of the V16/21 Duplex product manufactured by Belos – environmental impacts (DU: 1 product, 110 kg)

Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	1.60E+02	1.67E+00	1.17E+02	6.68E-01	5.74E-02	2.21E+00	1.16E-02	-9.08E+01
Greenhouse gas potential - fossil	eq. kg CO_2	1.58E+02	1.66E+00	1.15E+02	6.68E-01	5.71E-02	2.20E+00	1.16E+01	-9.10E+01
Greenhouse gas potential - biogenic	eq. kg CO_2	1.85E+00	5.68E-03	2.75E+00	5.73E-04	1.95E-04	1.89E-03	2.95E-02	-2.05E-01
Global warming potential - land use and land use change	eq. kg CO_2	1.26E-01	6.52E-04	3.36E-02	6.61E-05	2.24E-05	2.18E-04	1.09E-02	-1.16E-02
Stratospheric ozone depletion potential	eq. kg CFC 11	9.07E-06	3.84E-07	4.97E-06	1.42E-07	1.32E-08	4.67E-07	4.69E-06	-3.39E-06
Soil and water acidification potential	eq. mol H+	2.41E+00	6.74E-03	1.06E+00	3.33E-03	2.32E-04	1.10E-02	1.09E-01	-3.60E-01
Eutrophication potential - freshwater	eq. kg P	8.81E-02	1.12E-04	1.76E-01	2.05E-05	3.84E-06	6.77E-05	1.08E-03	-3.98E-02
Eutrophication potential - seawater	eq. kg N	2.05E-01	2.03E-03	1.57E-01	1.30E-03	7.00E-05	4.28E-03	3.79E-02	-7.93E-02
Eutrophication potential - terrestrial	eq. mol N	9.35E+00	2.22E-02	1.32E+00	1.42E-02	7.64E-04	4.69E-02	4.15E-01	-8.60E-01
Potential for photochemical ozone synthesis	eq. kg NMVOC	6.76E-01	6.80E-03	3.78E-01	4.01E-03	2.34E-04	1.32E-02	1.21E-01	-4.50E-01
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	6.09E-03	5.89E-06	4.69E-04	3.46E-07	2.03E-07	1.14E-06	2.66E-05	-1.57E-03
Abiotic depletion potential - fossil fuels	MJ	1.83E+03	2.46E+01	1.93E+03	8.91E+00	8.48E-01	2.94E+01	3.18E+02	-7.81E+02
Water deprivation potential	eq. m^3	6.63E+01	1.14E-01	3.34E+01	2.39E-02	3.92E-03	7.88E-02	1.01E+00	-1.66E+01

Table 4. Life cycle assessment (LCA) results of the V16/21 Duplex product manufactured by Belos – additional impacts indicators (DU: 1 product)

Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Particulate matter	disease incidence	INA	INA	INA	INA	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA	INA	INA	INA	INA

Table 5. Life cycle assessment (LCA) results of the V16/21 Duplex product manufactured by Belos - the resource use (DU: 1 product, 110 kg)

Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of renewable primary energy resources	MJ	1.33E+02	3.54E-01	1.17E+02	5.12E-02	1.22E-02	1.69E-01	2.76E+00	-6.40E+01
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of non-renewable primary energy resources	MJ	1.88E+03	2.46E+01	1.97E+03	9.65E+00	8.48E-01	3.18E+01	3.18E+02	-7.56E+02
Consumption of secondary materials	kg	1.45E+01	8.26E-03	1.46E-01	0.00E+00	2.84E-04	0.00E+00	6.68E-02	1.17E+01
Consumption of renewable secondary fuels	MJ	3.58E-03	9.11E-05	8.05E-04	0.00E+00	3.13E-06	0.00E+00	1.74E-03	-1.20E-03
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	1.27E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-6.32E-01
Net consumption of freshwater resources	m^3	9.69E-01	3.10E-03	2.85E-01	1.60E-04	1.07E-04	5.28E-04	3.48E-01	-8.87E-03

Table 6. Life cycle assessment (LCA) results of the V16/21 Duplex product manufactured by Belos – waste categories (DU: 1 product, 110 kg)

Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste	kg	4.47E-02	2.77E-02	3.96E+00	2.49E-05	9.52E-04	8.21E-05	3.37E-01	-9.97E-04
Non-hazardous waste	kg	4.65E+01	4.91E-01	1.38E+00	1.21E-02	1.69E-02	4.00E-02	4.76E+00	-1.96E-01
Radioactive waste	kg	6.01E-03	1.84E-06	1.62E-04	6.27E-05	6.33E-08	2.07E-04	2.11E-03	-1.98E-05
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
Materials for recycling	kg	8.28E-03	7.63E-05	2.18E+01	0.00E+00	2.63E-06	1.07E+02	6.36E-04	-6.82E-02
Materials for energy recovery	kg	2.67E-05	6.17E-07	1.82E-01	0.00E+00	2.12E-08	0.00E+00	7.53E-06	-2.54E-08

Verification

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years, if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) ☒ external ☐ internal
External verification of EPD: Halina Prejzner, PhD. Eng. LCA, LCI audit and input data verification: Michał Piasecki, PhD., D.Sc., Eng.

Note: The declaration owner has the sole ownership, liability, and responsibility for the declaration. Declarations within the same product category but from different programmes may not be comparable. Declarations of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- E EN 61109 VDE 0441-100:2009-06 Insulators for overhead lines Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V – Definitions, test methods and acceptance criteria
- ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification
- EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- ISO 20915:2018 Life cycle inventory calculation methodology for steel products
- KOBiZE Wskaźniki emisyjności CO_2, SO_2, NO_x, CO i pyłu całkowitego dla energii elektrycznej. Grudzień 2021
- World Steel Association 2017 Life Cycle inventory methodology report for steel products

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CERTIFICATE № 362/2022
of TYPE III ENVIRONMENTAL DECLARATION

Product:

V-suspension string for twin conductor bundle - V16/21-Duplex

Manufacturer:

BELOS-PLP S.A.

Gen. J.Kustronia 74, 43-301 Bielsko-Biała, Poland

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

EN 15804

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued for the first time on 20th September 2022 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, September 2022