Type III Environmental Product Declaration No. 449/2023

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BiTflame S(St), BiTflame S, BiTflame AS - Fireproof power and signal cables

Owner of the EPD:

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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 party 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. The intended use of an EPD is to communicate scientifically based environmental information for product, for the purpose of assessing the environmental performance of buildings.

Life cycle analysis (LCA): A1-A5, B1-B7, C1-C4 and D modules in accordance with EN 15804 (Cradle-to-Grave with module D)
The year of preparing the EPD: 2023
Product standards: EN 60228
Service Life: Reference service life of 30 years
PCR: ITB-PCR A v1.6
Declared unit: 1 km, throughput of 1A over a period of 30 years
Reasons for performing LCA: B2B
Representativeness: Polish, 2021

MANUFACTURER

Cable Factory BITNER is a Polish cable and wire manufacturer operating on the market since 1996. The offer is aimed at designers and construction companies as well as traders operating in the industrial, electrical, energy, telecommunication or IT automation. Cable Factory BITNER is a modern production plant located in Trzyciąż with 20,000 square meters of production, warehouse and office space on an area of several hectares. BITNER machine park consists of insulation lines, coating lines, lines for the production of rubber cables, both stranding and braiding machines, full metalwork equipment for the production of copper wires, an equipped in-house laboratories, quality certificates and certificates for products. In continuous production BITNER has several assortment groups covering the full range of cables up to 30 kV, with plastic and rubber coatings and insulation. Over 20 years of the company's activity have established the position of BITNER as one of the largest producers of cables and wires on the Polish market with an experienced crew of over 500 people, and experienced technology and development departments.

PRODUCTS DESCRIPTION AND APPLICATION

BiTflame®S(St) FE180/E90 is halogen-free fire resistant cable (copper based, 300/500 V) designed for installations in places where it is necessary to ensure operation of devices under fire conditions. They are recommended for emergency lighting installations, smoke extraction systems, alarm systems, signaling systems, sound warning and control systems, fire alarm signaling and automation and other safety ensuring circuits. Static screen (St) protects against interferences of external magnetic fields. Under fire conditions the cables ensure correct functioning of installation for at least 90 minutes (PH90) and insulation resistance to fire exposure for 180 minutes (FE180). During burning they do not emit corrosive gases or dense smoke. Cables are suitable for fixed installations inside buildings.

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BiTflame®AS(St) FE 180/E90 is halogen-free fire resistant telecommunication cable designed for emergency lighting installations, alarm-, signaling-, and teletransmission systems, in sound alarm systems as well as in fire warning systems, fire automation and other safety ensuring installations. Static screen (St) protects against interferences of external magnetic fields. Under fire conditions the cables ensure proper operation of installations for at least 90 minutes (PH90) and insulation

resistance to fire exposure for 180 minutes (FE180). During burning cables do not emit corrosive gases or dense smoke. Cables are suitable for fixed installations inside buildings. The cables tested in accordance with the requirements of DIN 4102 p. 12 and can be installed in E90 cable support systems as their elements (installation on clamps located every 30cm and 60cm).

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 km of installed fire resistant, halogen free, moisture protected instrumentation cable, used to transmit a reference energy (throughput of 1A over a period of 30 years for LCA purposes).

The results presented in the LCA (Tables 3-6) are presented for a 1 km long cable with the representative weight of 100 kg. To convert the impacts on cables with different weights per kilometer, use a conversion factor equal to the linear cable density (see manufacturer specific data in link) to the reference cable. *For example, if the cable weighs 150 kg/km, a conversion factor of 1.5 should be applied.*

System boundary

This EPD is based on a cradle-to-grave LCA and covers all the life cycle modules A1-A3, A4-A5, B1-B7, C1-C4, and D, in which 100 weight-% of the product has been accounted in accordance with EN 15804+A2 and ITB PCR A (cradle to grave). 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. The boundaries of the system are shown in Table 2.

Allocation

The allocation rules used for this EPD are based on general ITB's document PCR A. In the modules A1-A3, material losses in the assembly of the products in the factory are defined on the averaged specific values for the site. Input and output data from the production is inventoried and allocated to the cable production on the mass basis. The declaration covers a wide range of products (averaged). Their production resources and processing stages are basically similar, so it is possible to average the production by product volume.

System limits

All data obtained from the survey at the solar glass supplier and module manufacturer were taken into consideration, all available data from production have been considered, i.e. all raw materials/elements used as per assembly process, utilized thermal energy, and electric power consumption. Thus, material and energy flows contributing less than 1 % of mass or energy have been considered. It can be assumed that the total sum of neglected processes does not exceed 5 % of energy usage and mass per module A, B, C or D. Machines and facilities required during production are neglected. The production of etiquettes, tape and glue was also not considered.

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

The modules A1 and A2 represent the extraction and processing of raw materials and components and transport to the production site. The mass dominant input material (approx. 80%) is copper. Other input elements are plastic insulation, mica tape wrapping and halogen-free compounds. For

A2 module (transport) European averages for fuel data are applied and specific transport data (verified) is provided by the manufacturer in LIC questionnaire.

Module A3: *Production*

The production facilities of BITNER are primarily utilized copper wire drawing process and wire insulating. The product specific manufacturing process line is presented in Figure 1. Electricity, ON, LPG and natural gas are consumed in the processes. Losses and breakages from the line are recycled. The packaging of the cables in the functional unit consists of wooden reel.

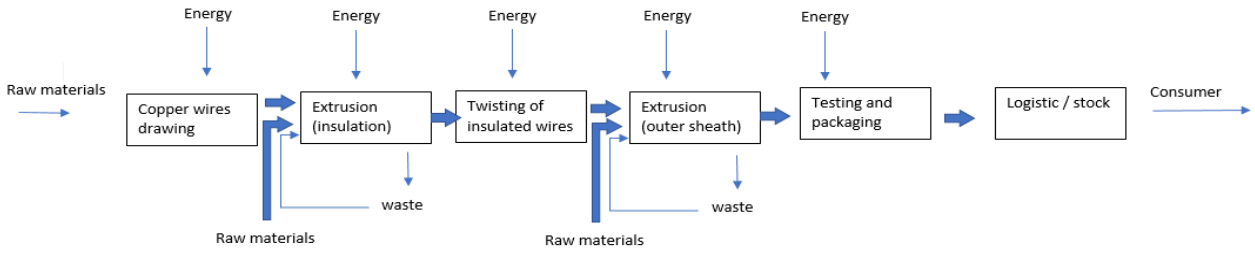

Fig. 1. A basic scheme of the cable manufacturing process

Module A4-A5 : Transport and installation

The transportation distance between production plant (Poland) and the building site is assumed as 300 km (lorry 10t, Euro 5). It should be recognized that the installation process (a potential losses) may vary depending on the specific site. It was assumed a certain amount of electricity necessary for power tools during installation A5.

Module B1-B7: Use stage

The cables are assumed as no directly emitting product during the life time. Actual data shows that no significant activities have been reported for use, maintenance, repair, replacement, refurbishment, and water use. This reflects an absence of impacts during the 30 years reference service life of the cable in these modules. No repair, replacement, or refurbishment (B3-B5) due to damage is expected within the RSL of 30 years. Furthermore, there is generally no operational water consumption associated with the use stage. Reference lifetime and use rate of energy wires and cables were consensually determined by the technical experts. For energy transmission products, energy consumption results in losses by Joule effect, over the use time (see equation 1):

$$E = R \cdot I^2 \cdot \Delta t \qquad (1)$$

where:
R: linear resistivity of the cable in Ω/km
I: current in A
Δt : use stage time in seconds
Concerning energy wires and cables, because of the wide and various possible uses of these products for a given application, and to ensure the comparability, the functional unit is expressed for a current of 1 A. Concerning the linear resistivity value of 10 Ω/km was used for LCA calculation.
This rule allows expressing the losses in Joule unit during cable use stage regardless of the use scenario. In this case, it is recommended using the Ampere specific multiplier for the actual cable use scenario in module B6 (see conversion rules).

Modules *C1-C4 and D: End-of-life (EOL)*

The deconstruction of the products covered by this study is assumed to be done manually with electric tools. The collection and waste treatment of photovoltaics is regulated by EU's Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE). In the adapted end-of-life scenario, the de-constructed products are transported to recycling plant on the distance 200 km with > 10t lorry, EURO 5. The recycling potential of recovered materials is presented in Table 1. Several of the materials used in the production have potential benefits and load beyond the system boundary. These include the following: copper – 90% copper (made from virgin ores), municipal plastics incineration: 10% electricity (average), 80% heat (average), 10% loss. Electricity generated through the waste incineration at the CHP plant is assumed to replace the average Polish electricity mix, while thermal energy is utilized as district heating in Poland. The recyclability of metals and plastics allows the producers a credit for the net scrap that is produced at the end of a product's life. The benefits from recycling of net scrap are described in formula from EN 15804:2012+A2:2019. Substitution of heat and electricity generated by the incineration with energy recovery of plastic insulation and other parts is also calculated in module D.

Table 1. End-of-life scenario for the product components

Material	Recycling/Reuse %	Landfilling %	Energy recovery %
Plastics	10	10	80
Copper	90	10	0
Other	0	100	0

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 BITNER. 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 database, Ecoinvent 3.9 is utilized for the background system (copper, plastics; EPR, EVA, PE, Mica, other) . As a result, both upstream- and downstream activities are based on average supply mixes for the specific region depending on the given dataset and KOBiZE data is used (Polish electricity mix and combustion factors for fuels). 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

The impacts of the representative products were aggregated using weighted average. Amounts of energy and material flows used at the manufacturing of the declared product were allocated by dividing the annual amounts with the specific production volume.

Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN 15804+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 emission factor is 0.698 kg CO_2/kWh (KOBiZE 2021). European electricity mix used is 0.430kg CO_2/kWh (Ecoinvent v3.9, RER). The product is compliant with the European Directive 2015/863 of 31 March 2015 on Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic equipment (RoHS) and regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). The EPD does not give information on release of dangerous substances to indoor air and release of dangerous substances to soil and water because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 km of the product manufactured by BITNER. The following life cycle modules (Table 2) were included in the analysis.

Table 2. System boundaries for the environmental characteristic of the BITNER cables

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**	**MD**	**MD**	**MD**	**MD**	**MD**	**MD**	**MD**	**MD**	**MD**	**MD**	**MD**	**MD**	**MD**	**MD**

The method of converting the environmental impact for a specific cable product

The results presented in the impatcs Table are presented for a 1 km long cable with an average weight of 100 kg. To convert the impacts on cables with different weights per kilometer, use a conversion factor equal to the linear density value of the assessed cable to the reference cable. For example, if the cable weighs 150 kg/km, a factor of 1.5 should be used. For the B6 module, the losses in a 30-year cycle (for a specific current intensity) should be calculated according to the formula (1).

Table 3. Life cycle assessment (LCA) results of the cables manufactured by BITNER – environmental impacts (DU: 1 km, used 30 years used to transmit 1A over a period of 30 years)

Indicator	Unit	A1-A3	A4	A5	B1-B5	B6	B7	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	5.49E+02	8.33E+00	6.98E+00	0.00E+00	1.83E+03	0.00E+00	6.98E+00	7.07E+00	5.15E+01	3.98E-02	-1.57E+02
Greenhouse potential - fossil	eq. kg CO_2	5.52E+02	8.31E+00	6.85E+00	0.00E+00	1.80E+03	0.00E+00	6.85E+00	7.05E+00	5.22E+01	3.95E-02	-1.56E+02
Greenhouse potential - biogenic	eq. kg CO_2	1.22E+02	2.20E-02	2.00E-01	0.00E+00	5.26E+01	0.00E+00	2.00E-01	2.41E-02	1.06E-05	2.99E-04	-1.15E+02
Global warming potential - land use and land use change	eq. kg CO_2	5.41E-01	3.26E-03	2.40E-03	0.00E+00	6.31E-01	0.00E+00	2.40E-03	2.77E-03	1.36E-05	3.91E-05	-3.46E-01
Stratospheric ozone depletion potential	eq. kg CFC 11	4.26E-05	1.92E-06	1.40E-07	0.00E+00	3.68E-05	0.00E+00	1.40E-07	1.63E-06	5.40E-08	1.33E-08	-1.73E-05
Soil and water acidification potential	eq. mol H+	9.20E+00	3.37E-02	7.60E-02	0.00E+00	2.00E+01	0.00E+00	7.60E-02	2.86E-02	1.16E+00	3.46E-04	-4.67E+00
Eutrophication potential - freshwater	eq. kg P	8.38E-01	5.35E-04	1.30E-02	0.00E+00	3.42E+00	0.00E+00	1.30E-02	4.74E-04	1.27E-05	8.87E-06	-1.24E-01
Eutrophication potential - seawater	eq. kg N	1.95E+00	1.02E-02	1.10E-02	0.00E+00	2.89E+00	0.00E+00	1.10E-02	8.63E-03	5.85E-01	1.20E-04	-1.25E+00
Eutrophication potential - terrestrial	eq. mol N	2.57E+01	1.11E-01	9.30E-02	0.00E+00	2.44E+01	0.00E+00	9.30E-02	9.42E-02	6.41E+00	1.30E-03	-1.93E+01
Potential for photochemical ozone synthesis	eq. kg NMVOC	5.75E+00	3.40E-02	2.60E-02	0.00E+00	6.83E+00	0.00E+00	2.60E-02	2.88E-02	1.58E+00	3.78E-04	-3.93E+00
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	3.54E-01	2.96E-05	3.34E-05	0.00E+00	8.78E-03	0.00E+00	3.34E-05	2.50E-05	2.00E-07	1.19E-07	-3.34E-01
Abiotic depletion potential - fossil fuels	MJ	9.63E+03	1.23E+02	1.16E+02	0.00E+00	3.05E+04	0.00E+00	1.16E+02	1.05E+02	9.80E-01	9.69E-01	-2.48E+03
Water deprivation potential	eq. m^3	2.87E+02	5.66E-01	2.40E+00	0.00E+00	6.31E+02	0.00E+00	2.40E+00	4.84E-01	9.41E-01	4.68E-03	-1.23E+02

Table 4. Life cycle assessment (LCA) results of the cables products manufactured by BITNER – additional impacts indicators (DU: 1 km)

Indicator	Unit	A1-A3	B1-B7	C1	C2	C3	C4	D
Particulate matter	disease incidence	INA	INA	INA	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA	INA	INA	INA

Table 5. Life cycle assessment (LCA) results of the cable products manufactured by BITNER - the resource use (DU: 1 km)

Indicator	Unit	A1-A3	A4	A5	B1-B5	B6	B7	C1	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable energy sources used as raw materials	MJ	1.82E+03	0.00E+00	8.60E+00	0.00E+00	2.26E+03	0.00E+00	8.60E+00	1.50E+00	1.52E-02	0.00E+00	-1.15E+03
Consumption of renewable primary energy resources used as raw ,aterials	MJ	1.04E+02	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	0.00E+00
Total consumption of renewable primary energy resources	MJ	1.92E+03	1.78E+00	8.60E+00	0.00E+00	2.26E+03	0.00E+00	8.60E+00	1.50E+00	1.52E-02	1.38E-02	-1.15E+03
Consumption of non-renewable primary energy - excluding renewable primary energy used as raw materials	MJ	9.22E+03	0.00E+00	1.16E+02	0.00E+00	3.06E+04	0.00E+00	1.16E+02	1.05E+02	-6.12E+02	0.00E+00	-2.17E+03
Consumption of non-renewable primary energy resources used as raw materials	MJ	3.96E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.13E+02	0.00E+00	-7.12E+00
Total consumption of non-renewable primary energy resources	MJ	9.79E+03	1.33E+02	1.16E+02	0.00E+00	3.06E+04	0.00E+00	1.16E+02	1.05E+02	9.80E-01	1.02E+00	-2.64E+03
Consumption of secondary materials	kg	1.80E+00	0.00E+00	1.06E-02	0.00E+00	2.79E+00	0.00E+00	1.06E-02	3.51E-02	1.30E-04	7.59E-05	-8.33E-01
Consumption of renew. secondary fuels	MJ	1.64E+00	0.00E+00	5.91E-05	0.00E+00	1.55E-02	0.00E+00	5.91E-05	3.86E-04	3.40E-06	1.98E-06	-7.67E-05
Consumption of non-renewable secondary fuels	MJ	5.03E+00	0.00E+00	9.39E-02	0.00E+00	2.47E+01	0.00E+00	9.39E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net consumption of freshwater	m^3	1.32E+02	6.14E-03	3.15E-02	0.00E+00	8.28E+00	0.00E+00	3.15E-02	1.32E-02	8.00E-03	4.90E-04	-1.22E+02

Table 6. Life cycle assessment (LCA) results of the cable products manufactured by BITNER – waste categories (DU: 1 km

Indicator	Unit	A1-A3	A4	A5	B1-B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	6.29E+00	3.28E-04	1.20E-03	0.00E+00	3.15E-01	0.00E+00	1.20E-03	1.17E-01	2.00E-02	3.84E-04	-4.72E+00
Non-hazardous waste	kg	6.67E+02	6.46E+00	6.24E-02	0.00E+00	1.64E+01	0.00E+00	6.24E-02	2.08E+00	5.40E-02	2.51E+00	-5.76E+02
Radioactive waste	kg	9.52E-03	8.50E-04	8.70E-05	0.00E+00	2.29E-02	0.00E+00	8.70E-05	7.81E-06	4.00E-08	6.09E-06	-2.82E-03
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	0.00E+00	0.00E+00
Materials for recycling	kg	7.19E+00	0.00E+00	1.20E-04	0.00E+00	3.15E-02	0.00E+00	1.20E-04	3.24E-04	1.60E-06	7.22E-07	-7.92E-02
Materials for energy recovery	kg	2.33E-04	0.00E+00	1.05E-06	0.00E+00	2.76E-04	0.00E+00	1.05E-06	2.62E-06	1.96E-07	8.56E-09	-1.42E-04
Exported Energy	MJ	2.95E+01	0.00E+00	3.46E-01	0.00E+00	9.09E+01	0.00E+00	3.46E-01	0.00E+00	3.20E-04	0.00E+00	-9.27E+00

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 (sub clause 8.1.3.) [X] 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 v 1.6. (2023) General Product Category Rules for Construction Products
- EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and system
- Ecoinvent 3.9 data set, https://ecoinvent.org/
- EN 60228 Conductors of insulated cables
- 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
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- KOBiZE Wskaźniki emisyjności CO_2, SO_2, NO_x, CO i pyłu całkowitego dla energii elektrycznej. Grudzień 2021

Signature Not Verified
Dokument podpisany przez Michał Piasecki, ITB
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Instytut Techniki Budowlanej

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CERTIFICATE № 449/2023
of TYPE III ENVIRONMENTAL DECLARATION

Products:

BiTflame S(St), BiTflame S, BiTflame AS
- Fireproof power and signal cables

Manufacturer:

Zakłady Kablowe BITNER Sp. z o.o.

ul. Józefa Friedleina 3/3, 30-009 Kraków, 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+A2

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

This certificate, issued on 5th May 2023 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, May 2023