ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH:
EN 15804+A2 & ISO 14025

Product name:
Cast Aluminum Circuit Breaker Housing (ref. 17650) for Blue GIS Systems

EPD holder:

Thoni Alutec Sp. z o.o.

Issued on 18 February 2026
Valid until 18 February 2031

GENERAL INFORMATION

EPD OWNER

Manufacturer / EPD Holder	Thoni Alutec Sp. z o.o.
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PRODUCT IDENTIFICATION

Product name	Cast Aluminum Circuit Breaker Housing (ref. 17650) for Blue GIS Systems
Place(s) of production	Poland

EPD INFORMATION

EPD Polska program operator	Multicert Sp. z o.o. Ul. Mydlarska 47, 04-690 Warszawa, Poland www.epd.org.pl, epd@epd.org.pl
EPD standards	This EPD is in accordance with EN 15804+A2 and ISO 14025 standards.
Product category rules	The EN 15804+A2 standard serves as the core PCR.
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal certification ☒ External verification
EPD verifier	Izabela Sztamberek-Sochan, Ph.D.
EPD number	EPD-P 01.02.2026
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Publishing date	18 February 2026
EPD valid until	18 February 2031
Reasons for performing LCA	B2B
Accountability	The EPD Holder is responsible for the information provided and evidence. Multicert Sp. z o.o. does not hold responsibility for the manufacturer information, life cycle assessment data nor supporting evidence.

EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

COMPANY INFORMATION

HOLDER OF THE EPD

Thoni Alutec Sp. z o.o.
ul. Przyszowska 1
37-450 Stalowa Wola
Poland

Company Overview:

Thoni Alutec Sp. z o.o. is a customer-oriented aluminum foundry located in Stalowa Wola, Poland. The company is part of an international family-owned group with over 60 years of tradition in casting technology. The Polish facility was established in 1998 and has since developed into a modern production center serving demanding industrial sectors across Europe. The Stalowa Wola facility is equipped with state-of-the-art casting and machining technology, providing comprehensive aluminum casting solutions from raw material to finished, ready-to-install components.

Technical Profile

The facility offers a broad portfolio of technological processes encompassing 6 different molding and casting methods: sand casting using cold resin molding process, sand casting using wet molding method (Seiatsu process), gravity die casting, low-pressure die casting, vacuum molding method (V-Process), and 3D sand printing. The range of casting weights produced extends from 5 kg to 3,000 kg, with annual production volumes ranging from single units to 30,000 pieces.

The facility is characterized by broad vertical integration, covering the complete technological chain from aluminum alloy melting, through casting, heat treatment (solution treatment and aging), CNC machining (including 6-axis technologies), welding of complex assemblies, to final surface finishing (spray painting, powder coating, galvanization). The in-house tool shop is responsible for designing and manufacturing patterns, dies, and specialized tooling. The R&D department conducts computer simulations and optimization of component designs.

Target Industries and Applications

The Stalowa Wola facility supplies certified, ready-to-install aluminum components for demanding industrial sectors, including: railway transport, medical industry, energy sector, e-mobility, renewable energy, aerospace, machinery construction, robotics, defense industry, shipbuilding, oil and gas, and architecture. Products manufactured at the facility are used in high-speed train constructions, medical equipment (CT scanners), gearboxes, power distribution systems, wind turbines, and advanced technical systems.

Quality Management Systems and Certifications

The facility has implemented a comprehensive quality assurance system encompassing metallurgical control of alloys, advanced measurement technology (including 3D scanners), non-destructive testing (NDT) using radiographic methods, and mechanical testing of casting properties. All production processes are carried out in accordance with international standards and quality requirements for high-demand industries.

Logistics and Distribution

The strategically located facility in Stalowa Wola, Poland, ensures efficient distribution throughout Europe. The company collaborates with reliable transport partners, using advanced real-time shipment tracking systems. Implementation of just-in-time principles minimizes inventory and increases delivery flexibility for customers across European markets.

Sustainability

The Stalowa Wola facility implements a comprehensive sustainability strategy based on six pillars: management compliant with REACH and CO_2 reduction policy, internal recycling of molding materials and aluminum, utilization of waste heat from melting processes, external recycling of all auxiliary materials, procurement of low-emission aluminum, and optimization of production processes. The facility employs modern melting and heating technologies with the highest available energy efficiency, regularly investing in infrastructure modernization. Internal logistics is electrified, and packaging is systematically replaced with reusable solutions.

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PRODUCT INFORMATION

PRODUCT DESCRIPTION

The subject of this assessment is an aluminium casting serving as a Circuit Breaker Housing, reference number 17650. It is a critical structural component used in the Blue GIS (Gas-Insulated Switchgear) product family by Siemens Energy.

The housing is designed as a hermetic enclosure capable of withstanding internal gas pressure and acts as a protective enclosure for the internal operating elements of the circuit breaker. The casting features precision-engineered connection flanges (highlighted in red in the technical documentation), which ensure high gas tightness and enable modular assembly within larger switchgear units.

The declared product is manufactured using sand casting with a cold resin molding process. This technology is selected to meet the requirements related to complex geometry, mechanical performance and tightness of the aluminum housing.

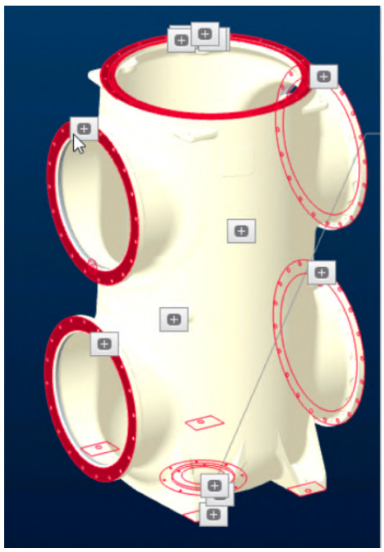

Figure 1: Drawing of the Circuit Breaker Housing number 17650.

PRODUCT VARIANTS

To demonstrate the environmental benefit of sustainable material sourcing, this EPD declares two material variants:

Option 1 (Baseline): Manufactured using standard primary aluminum based on industry-average global production data.

Option 2 (Low-carbon): Manufactured using certified low-carbon primary aluminum from a specific supplier with a verified lower carbon footprint.

Both variants share identical technical specifications, geometry, and manufacturing processes at the Thoni Alutec facility.

PRODUCT APPLICATION

The product is a high-precision Circuit Breaker Housing (ref: 17650), designed as a fundamental structural component for Gas-Insulated Switchgear (GIS) systems. Its primary application is to serve as a robust, pressure-resistant enclosure that houses and protects the internal switching mechanisms of the circuit breaker.

PRODUCT STANDARDS

The declared product is manufactured as an aluminum casting in accordance with the following standards:

• EN 1706:2010 – Aluminium and aluminium alloys – Castings – Chemical composition and mechanical properties.

• EN 1559-1:2010 – Founding – Technical conditions of delivery – Part 1: General.

The product is designed as a structural component of high-voltage switchgear equipment and meets the relevant requirements of:

• EN 62271-1 / IEC 62271-1 – High-voltage switchgear and controlgear – Part 1: Common specifications.

The declared product may be used as part of gas-insulated switchgear systems that fall under the scope of Directive 2014/68/EU (Pressure Equipment Directive – PED). Compliance with PED requirements is ensured at the level of the complete equipment and its conformity assessment.

PRODUCT RAW MATERIAL COMPOSITION

The declared product has a total mass of 394.5 kg. It is manufactured primarily from primary aluminum casting alloy AlSi7Mg0.3 in accordance with EN 1706:2010, which accounts for 390 kg (approx. 98.9%) of the product's mass. The remaining 4.5 kg (approx. 1.1%) consists of the polymer paint used for surface protection.

SUBSTANCES, REACH - VERY HIGH CONCERN

The declared product group is not expected to contain substances of very high concern (SVHC) listed under REACH in concentrations above 0.1% by weight. The products are inert in use and do not require chemical treatments during the service life.

PRODUCT LIFE-CYCLE

RAW MATERIAL SUPPLY (A1)

Module A1 covers the procurement of raw materials and auxiliary materials used for the production of the Circuit Breaker Housing (ref. 17650).

The main raw material input is the metallic charge used for melting and casting. All aluminum purchased from external suppliers is primary aluminum; no externally sourced recycled aluminum is used in the production of the declared product.

The melting process at the Thoni Alutec facility operates with a closed internal material loop. The total gross furnace charge used in the LCA amounts to 596 kg and consists of approximately 70% purchased primary aluminum (417.2 kg) and 30% internal foundry returns (178.8 kg), such as runners, risers and internal machining scrap generated during the production of aluminum castings at the same facility. These internal returns do not leave the system boundary and are directly reintroduced into the melting process in order to improve material efficiency and minimize waste generation. In accordance with EN 15804+A2, internal foundry returns are not considered secondary material (SM) and are treated as an internal material loop with zero upstream environmental burden.Consequently, the declared product is classified, in accordance with EN 15804+A2, as being manufactured from primary aluminum.

Module A1 accounts for the total amount of primary aluminum required to achieve the declared product mass, including inherent process losses occurring during melting, casting and finishing operations, such as aluminum chips, dross from melting and dust from surface treatment processes. Two material sourcing options are declared. Option 1 is modelled using industry-average primary aluminum datasets from the ecoinvent database.

For Option 2, the upstream dataset for purchased primary aluminium is based on a third-party verified Environmental Product Declaration for EcoLum™ Aluminum Foundry Alloys manufactured by Alcoa USA Corp. (Programme operator: UL Environment; Declaration No. 4790734502.101.1; issue date June 1, 2023; validity 5 years). The declared unit in the source EPD is 1000 kg and the reported climate change impact is GWP-total A1–A3 = 4.92E+03 kg CO_2 eq, corresponding to approx. 4.92 kg CO_2 eq per 1 kg of declared aluminium alloy product. The source EPD represents aluminium produced predominantly with hydro-electric power and is used here to model the upstream impacts of externally purchased low-emission aluminium in Module A1. The supplier EPD represents an aluminium alloy product supplied to the foundry and is used as a conservative upstream proxy for purchased primary aluminium input in Module A1.

Apart from the upstream primary aluminum dataset used in Module A1, all other assumptions, system boundaries and manufacturing processes are identical for both options.

Module A1 also includes the following auxiliary materials, where relevant to the declared product:

Mould and core production materials: The casting process utilizes silica sand reinforced with a resin additive (approx. 0.6%). In accordance with the circular economy principles of the foundry, the LCA calculation accounts only for the portion of the sand that is not recovered for internal reuse and must be replaced by fresh material.

Polymer paint: Used for high-quality surface protection and corrosion resistance of the finished housing.

Packaging and handling materials: For logistics and delivery, including wooden pallets and fibreboard.

TRANSPORT OF RAW MATERIALS (A2)

Module A2 covers the transport of raw materials and auxiliary materials from suppliers to the Thoni Alutec's manufacturing facility located in Stalowa Wola, Poland.

The delivery of primary aluminum is partially realized via sea freight using container vessels and partially by road. All other raw materials, additives, and packaging materials are transported by road using diesel-powered trucks, typically with a payload capacity above 16 tonnes and compliant with EURO 6 emission standards.

The transport modelling is based on representative transport distances reflecting typical supply chains for the declared raw materials. Where specific supplier distances are not available, average transport distances are applied to ensure a realistic and conservative transport scenario.

MANUFACTURING (A3)

Module A3 covers the manufacturing processes carried out at the production facility, including mould and core preparation, melting and casting of aluminum, finishing operations, and internal transport.

Preparation of moulds and cores involves the use of silica sand, with the addition of new sand to compensate for process losses and maintain required moulding properties using resin and resin hardener. Electrical energy is consumed by moulding lines and sand reclamation systems. Waste streams generated at this stage consist primarily of waste moulding sand purged from circulation.

Melting and casting of the aluminum housing are carried out using electrically powered melting furnaces. The process utilizes a charge of primary aluminum ingots and internal returns. To achieve the required metallurgical quality, refining gases and grain refiners are used. Natural gas may be used for ladle heating and furnace operations. Aluminum dross and slag generated during the melting process are treated as production waste.

Finishing and machining operations include shot blasting, CNC machining, and leak testing using compressed air. Materials used at this stage include cutting fluids, coolants, and cemented carbide tools. Electrical energy is consumed by finishing equipment, machining centres, and cranes. Waste streams generated include aluminum chips (sent for external recycling), spent blasting media, and used cooling emulsions.

Surface protection of the aluminum housing is provided by application of industrial coating systems suitable for corrosion protection and product durability. The applied coating system consists of an epoxy-based protective layer and a solvent-borne finishing coating, applied in an industrial painting process and cured under controlled conditions.

The coating application and curing processes are included within the system boundary of Module A3 together with their associated energy consumption and emissions. Any emissions of non-methane volatile organic compounds (NMVOC) related to coating application, where relevant, are included in the results reported for Module A3.

Note: Emissions of non-methane volatile organic compounds (NMVOC) accounted for in Module A3 originate primarily from the thermal decomposition of organic resin binders used in mould and core systems during the casting process, particularly at pouring and shake-out stages. Direct NMVOC emissions amount to approximately 1.0 kg per declared unit. These emissions are reflected in the POCP indicator reported for Module A3 and A1–A3 and are not reported as a separate mandatory output flow in accordance with EN 15804+A2. The surface coating process itself is not a significant source of NMVOC emissions.

Internal transport and handling within the production facility are carried out using overhead cranes and battery-powered forklifts. Energy consumption and waste streams associated with internal logistics and final packaging (using soft wood and fiberboard) are included in Module A3.

Material	Description	Mass (kg)
Soft wood	Wooden pallet with top board (1200 × 1000 mm)	40,0
Fiberboard	Protective fibreboard elements and spacers	7,5
Plastics	PET strapping tapes and auxiliary tapes (negligible)	<1.0

Table 1: Packaging materials used for transport and handling (informative)

Energy consumption in Module A3 is based on primary, site-specific data collected at the Thoni Alutec manufacturing facility for the reference year 2024.

TRANSPORT TO CONSTRUCTION SITE & INSTALLATION (A4, A5)

Modules A4 (Transport to construction site) and A5 (Installation) are not declared in this Environmental Product Declaration. The declared product group consists of aluminum components supplied to industrial customers. The transport to the construction site as well as installation processes depend on the specific project, application, and logistics arrangements, which are outside the control of the manufacturer.

USE STAGE (B1-B7)

Modules B1 to B7 are declared with zero environmental impact. The aluminum components covered by this EPD are passive structural elements of the circuit breaker. As such, they do not consume energy or water during the use stage and do not require maintenance, repair, replacement, or refurbishment. No operational emissions occur during the use phase.

END OF LIFE STAGE (C1, C2, C3, C4)

The end-of-life scenario is modeled based on standardized recovery practices for aluminum alloy castings, assuming a high efficiency of material circularity.

- Deconstruction / Demolition (C1): The component is removed from the circuit breaker by selective mechanical dismantling using a diesel forklift with estimated time of 1.5 hours. Manual electrical disconnection is considered to have negligible energy consumption.
- Transport (C2): Transport of end-of-life material to a recycling facility or landfill is modeled as a 100 km distance covered by heavy-duty trucks (>16 t). The model accounts for a 75% collection rate (292.5 kg) for recycling and 25% (97.5 kg) for disposal.
- Waste processing (C3): The fraction sent to recycling (75% of total mass) is processed with a 95% recycling efficiency (metal yield). This stage includes shredding, sorting, and refining to reach the end-of-waste state.
- Disposal (C4): The non-collected fraction (25% of the initial mass) and process losses from recycling are disposed of in a non-hazardous waste landfill. As aluminum is an inert material, emissions from this stage are considered negligible.

BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

Module D accounts for the environmental benefits resulting from the high recyclability of the aluminum alloy. The calculation follows the system expansion approach per EN 15804+A2.

Based on a 75% collection rate and 95% process efficiency, the overall recovery rate is calculated at approximately 70% of the aluminum content. The recovered aluminum mass (approx. 273 kg) substitutes the production of primary aluminum on a 1:1 ratio.

LIFE-CYCLE ASSESSMENT

LIFE-CYCLE ASSESSMENT INFORMATION

Period for data	2024

DECLARED AND FUNCTIONAL UNIT

Declared Unit	1 unit of Circuit Breaker Housing (ref: 17650)
Mass per Declared Unit	394,5 kg

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in the product, kg C:	0,0
Biogenic carbon content in the packaging, kg C:	23,8

Note: The biogenic carbon is present in wood-based packaging materials (pallets and cardboard). This carbon is temporarily stored during the product life cycle and accounted as negative emissions in Module A1 (uptake during tree growth) and positive emissions in Module C4 (release at end-of-life), resulting in climate neutrality over the full life cycle.

SYSTEM BOUNDARY

The EPD scope is "cradle-to-gate with options" in accordance with EN 15804. The study covers the product stage A1–A3 and additionally includes selected optional life-cycle modules: C1–C4 (end-of-life: deconstruction, waste transport, waste processing and disposal), and D (benefits and loads beyond the system boundary from material recovery / avoided burdens). Modules A4 and A5 are marked as MND (Module Not Declared) because the products have various applications depending on specific construction projects. Modules B1–B7 are marked as MNR (Module Not Relevant) as the products are passive and do not require energy, water, or maintenance during the use stage.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MNR	MNR	MNR	MNR	MNR	MNR	MNR	X	X	X	X	X
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deinstallation/Demolition	Transport	Waste processing	Disposal	Reuse / Recycling

X – module included/declared
MND – Module Not Declared
MNR – Module Not Relevant

CUT-OFF CRITERIA

The study fully covers all mandatory EN 15804:2012+A2:2019 modules and processes. No hazardous materials or substances have been omitted from the system boundary.

All major raw material and energy inputs are included. All inputs and outputs from unit processes for which data are available are taken into account in the calculations. No single neglected unit process exceeds 1% of the total mass or energy flows. The total of all neglected input and output flows does not exceed 5% of the total mass or energy use.

The production of capital goods (equipment), construction of infrastructure, and the maintenance and operation of capital equipment are excluded. Personnel-related activities, as well as energy and water use associated with company management and sales/administrative activities, are also excluded.

ESTIMATES AND ASSUMPTIONS

The life cycle assessment (LCA) underlying this Environmental Product Declaration (EPD) was carried out in accordance with EN 15804:2012+A2:2019, applying established rules for system boundaries, allocation, cut-off criteria and data quality.

The LCA model is based on a combination of product-specific primary data and site-level operational data, reflecting the level of data availability for the declared product.

Product-specific primary data were available for key physical parameters directly related to the declared product, the net mass of the aluminum casting, the mass of mould and core materials required for the specific casting geometry, and the mass of surface coating and packaging materials applied per declared unit.

The composition of the metallic charge, consisting of 70% purchased primary aluminum and 30% internal foundry returns, is based on production records and represents a product-specific technological assumption applied consistently in the LCA model. Internal foundry returns are treated as an internal material loop with zero upstream environmental burden, in accordance with EN 15804+A2.

For production processes and flows that could not be measured at the level of an individual casting — including electricity consumption and natural gas use, internal material flows, auxiliary materials, emissions and production waste streams — representative site-level operational data were used. Where site-level data were applied, environmental burdens were attributed to the declared product using mass-based allocation, as described in the *Allocation* section.

Raw Material Supply (A1): Both declared options assume 100% primary aluminum input. Option 1 utilizes industry-average primary aluminum datasets from the ecoinvent database, while Option 2 utilizes supplier-specific EPD data to reflect low-emission primary aluminum production.

Transport (A2): Transport modelling is based on representative distances, assuming road transport via EURO 6 compliant diesel-powered trucks with a payload capacity above 16 tonnes. The delivery of primary aluminum is partially realized via sea freight and partially by road, whereas all other raw materials are transported exclusively by road.

Use stage (B1–B7): The declared products are passive structural components with no energy or water consumption during the use stage. Consequently, modules B1–B7 are reported as MNR (Module Not Relevant) or with zero environmental impact in the results tables.

End-of-life and Module D: End-of-life modelling is based on a standardized recycling-oriented scenario for aluminum, assuming a 75% collection rate at the dismantling site and a 95% material recovery efficiency for the collected fraction. Environmental benefits beyond the system boundary (Module D) are calculated using a net-scrap substitution approach. Module D is identical for both options and represents substitution of average primary aluminum production on the global market, regardless of the specific A1 source.

ALLOCATION

Allocation was carried out in accordance with EN 15804+A2, applying a hierarchical approach that prioritizes the use of product-specific primary data where available and applies mass-based allocation for shared production processes based on representative site-level data.

- Product-specific data directly attributed to the declared product

  The following parameters were quantified specifically for the Circuit Breaker Housing (ref. 17650) based on technical documentation, production records and direct measurements for this product:

  - the net mass of the finished aluminum casting,
  - the mass of mould and core materials required for the specific casting geometry,
  - the mass of surface coating (polymer paint) applied per declared unit,
  - the mass of packaging materials (e.g. wooden pallets, cardboard and spacers), based on the specific packaging configuration used for this product.

  These parameters are directly linked to the declared unit and therefore did not require allocation.

- Mass-based allocation of shared production processes

  Other inputs and outputs used in the LCA model — including electricity consumption, generation of internal foundry returns, sand make-up for mould and core production, auxiliary materials, emissions and production waste streams — could not be measured at the level of an individual casting. These flows are associated with shared production processes used for the overall manufacturing of aluminum castings produced using sand moulding technologies at the facility.

  For these shared processes, mass-based allocation was applied in accordance with EN 15804+A2. Allocation was based on the ratio of the mass of the declared product to the total mass of aluminum castings manufactured using sand moulding processes at the site during the reference period.

  Mass-based allocation is considered appropriate for this product group, as energy demand, internal material flows, waste generation and auxiliary material consumption are primarily driven by the mass of cast products processed within the sand casting system.

  This approach ensures a transparent, conservative and representative attribution of environmental impacts to the declared product, fully consistent with site-level production data and the requirements of EN 15804+A2.

DATA QUALITY

The life cycle assessment (LCA) is based on high-quality foreground data collected by Thoni Alutec for the reference period covering the full year 2024.

Product-specific primary data were available for key physical parameters of the declared product, including the net mass of the aluminum casting, the mass of mould and core materials required for the specific casting geometry, and the mass of surface coating and packaging materials applied per declared unit.

The composition of the metallic charge, including the specific ratio of 70% purchased primary aluminum and 30% internal foundry returns, is based on production records and represents a product-specific technological assumption used in the LCA model.

For production processes and flows that could not be measured at the level of an individual casting — including electricity consumption and natural gas use, internal material flows, auxiliary materials, emissions and production waste streams — representative site-level operational data were used. These data are representative of the overall foundry operations and of the production of aluminum alloy castings manufactured using sand moulding technologies for Siemens Energy's Blue GIS products covered by this EPD.

Where site-level data were applied, environmental burdens were attributed to the declared product using mass-based allocation, in accordance with EN 15804+A2 and as described in the *Allocation* section.

Upstream data for alloying elements and auxiliary materials, such as silica sand and furan resins and hardeners, were sourced from industry-average datasets aligned with EN 15804+A2 requirements. Background datasets, including those for energy supply, transport, and raw material extraction, were derived from the ecoinvent v3.9.1 database.

Electricity consumption in Module A3 is modelled using the national electricity mix for Poland, reflecting current emission factors. All major material and energy inputs are included, and no single excluded process exceeds 1% of total mass or energy flows, with the cumulative contribution of excluded processes remaining below 5%, in accordance with the applied cut-off criteria.

The overall data quality is considered appropriate for the intended use of this EPD.

GEOGRAPHIC REPRESENTATIVENESS

The product system is manufactured and managed in Poland (Europe).

ENVIRONMENTAL IMPACT DATA – OPTION 1 (BASELINE)

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
GWP-Total	kg CO2 eq.	3,16E+03	9,36E+01	1,37E+03	4,62E+03	MND	MNR	1,59E+01	7,22E+00	3,37E+00	8,46E+01	-2,10E+03
GWP-fossil	kg CO2 eq.	3,15E+03	9,35E+01	1,36E+03	4,60E+03	MND	MNR	1,59E+01	7,21E+00	3,43E+00	3,82E+00	-2,04E+03
GWP-biogenic	kg CO2 eq.	-5,92E+01	7,04E-02	7,42E+00	-5,17E+01	MND	MNR	3,65E-03	6,60E-03	-5,91E-02	8,07E+01	-1,21E+01
GWP-LULUC	kg CO2 eq.	6,99E+01	4,76E-02	4,08E-01	7,04E+01	MND	MNR	1,79E-03	3,56E-03	2,81E-03	4,10E-03	-4,83E+01
ODP	kg CFC-11 eq.	9,31E-05	2,08E-06	6,53E-06	1,02E-04	MND	MNR	2,53E-07	1,57E-07	3,49E-08	4,40E-08	-6,13E-05
AP	mol H+ eq.	2,01E+01	3,60E-01	9,62E+00	3,01E+01	MND	MNR	1,47E-01	1,58E-02	3,19E-02	2,44E-02	-1,31E+01
EP-freshwater	kg P eq.	1,81E+00	6,78E-03	1,60E+00	3,42E+00	MND	MNR	4,90E-04	5,10E-04	2,97E-03	1,13E-03	-1,17E+00
EP-marine	kg N eq.	2,84E+00	9,42E-02	1,43E+00	4,37E+00	MND	MNR	6,83E-02	3,97E-03	5,75E-03	6,33E-03	-1,83E+00
EP-terrestrial	mol N eq.	2,61E+01	9,94E-01	1,22E+01	3,92E+01	MND	MNR	7,43E-01	4,04E-02	6,67E-02	6,75E-02	-1,66E+01
POCP	kg NMVOC eq.	1,13E+01	4,59E-01	4,55E+00	1,63E+01	MND	MNR	2,20E-01	2,45E-02	1,83E-02	2,23E-02	-7,22E+00
ADPE (disc.2)	kg Sb eq.	2,88E-03	1,80E-04	4,70E-04	3,53E-03	MND	MNR	3,08E-06	1,68E-05	4,43E-05	4,13E-06	-1,52E-03
ADPF (disc.2)	MJ, (NCV)	5,05E+04	1,41E+03	1,55E+04	6,75E+04	MND	MNR	2,10E+02	1,03E+02	3,89E+01	5,50E+01	-3,16E+04
WDP (disc.2)	m3 World eq.	6,10E+03	7,15E+00	2,88E+02	6,40E+03	MND	MNR	5,19E-01	5,12E-01	8,52E-01	6,79E-01	-4,03E+03
Acronyms	GWP-total – Climate change, total global warming potential; GWP-fossil – Climate change, fossil fuels; GWP-biogenic – Climate change, biogenic carbon; GWP-luluc – Climate change, land use and land use change; ODP – Ozone layer depletion; AP – Acidification of terrestrial and freshwater environments; EP-freshwater – Eutrophication, freshwater; EP-marine – Eutrophication, marine; EP-terrestrial – Eutrophication, terrestrial; POCP – Photochemical ozone formation (smog formation); ADPE – Abiotic depletion, minerals and metals; ADPF – Abiotic depletion, fossil fuels; WDP – Water scarcity (water use deprivation potential); NCV - net calorific value.											
Disclaimer 2	The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.											

Note: For aluminium castings produced using the same material composition and manufacturing technology, the A1–A3 impacts scale approximately with product mass. For Ref. 17650 this corresponds to an indicative GWP total emission intensity of 11.7 kg CO_2 eq per kg of product; this value is provided for information only and does not replace a product-specific LCA.

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
PM	Disease Incidence	2,20E-04	6,60E-06	1,68E-05	2,43E-04	MND	MNR	4,07E-06	4,29E-07	3,05E-07	3,74E-07	-1,40E-04
IRP (disc.1)	kBq U235 eq.	8,58E+02	1,79E+00	4,43E+01	9,04E+02	MND	MNR	9,88E-02	1,39E-01	1,05E-01	2,39E-01	-5,50E+02
ETP-fw (disc.2)	CTUe	1,34E+04	6,76E+02	4,10E+03	1,81E+04	MND	MNR	9,94E+01	5,05E+01	2,40E+01	8,07E+02	-8,15E+03
HTP-c (disc.2)	CTUh	1,01E-05	4,12E-08	4,16E-07	1,05E-05	MND	MNR	4,84E-09	3,23E-09	5,87E-09	3,39E-09	-6,49E-06
HTP-nc (disc.2)	CTUh	8,38E-05	8,40E-07	1,50E-05	9,96E-05	MND	MNR	3,04E-08	6,32E-08	1,22E-07	4,06E-08	-5,70E-05
SQP (disc.2)	Dimensionless	1,25E+04	1,31E+03	3,39E+03	1,72E+04	MND	MNR	1,40E+01	6,19E+01	2,48E+02	6,75E+01	-2,18E+03
Acronyms	PM – Particulate matter emissions (potential incidence of disease);IRP – Ionising radiation, human health exposure potential; ETP-fw – Ecotoxicity, freshwater; HTP-c – Human toxicity, cancer effects; HTP-nc – Human toxicity, non-cancer effects; SQP – Land use related impacts, soil quality.											
Disclaimer 1	This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possibe nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.											
Disclaimer 2	The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.											

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
PERE	MJ, (NCV)	1,87E+04	2,07E+01	1,41E+03	2,02E+04	MND	MNR	1,18E+00	1,61E+00	5,37E+00	3,68E+00	-1,27E+04
PERM	MJ, (NCV)	1,51E+03	0,00E+00	0,00E+00	1,51E+03	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ, (NCV)	2,02E+04	2,07E+01	1,41E+03	2,17E+04	MND	MNR	1,18E+00	1,61E+00	5,37E+00	3,68E+00	-1,27E+04
PENRE	MJ, (NCV)	4,97E+04	1,41E+03	1,55E+04	6,66E+04	MND	MNR	2,10E+02	1,03E+02	3,89E+01	5,50E+01	-3,16E+04
PENRM	MJ, (NCV)	8,19E+02	0,00E+00	0,00E+00	8,19E+02	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ, (NCV)	5,05E+04	1,41E+03	1,55E+04	6,75E+04	MND	MNR	2,10E+02	1,03E+02	3,89E+01	5,50E+01	-3,16E+04
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ, (NCV)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ, (NCV)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m3	1,57E+02	2,44E-01	4,08E+01	1,98E+02	MND	MNR	1,86E-02	1,69E-02	6,72E-02	4,61E-02	-1,02E+02
Acronyms	PERE – Use of renewable primary energy as energy carriers; PERM – Use of renewable primary energy resources as raw materials; PERT – Total use of renewable primary energy resources (PERE + PERM); PENRE – Use of non-renewable primary energy as energy carriers; PENRM – Use of non-renewable primary energy resources as raw materials; PENRT – Total use of non-renewable primary energy resources (PENRE + PENRM); SM – Use of secondary material; RSF – Use of renewable secondary fuels; NRSF – Use of non-renewable secondary fuels; FW – Net use of fresh water; NCV - net calorific value.											

OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	1,30E+01	1,30E+01	MND	MNR	0,00E+00	0,00E+00	2,93E+02	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Acronyms	CRU – Components for re-use; MFR – Materials for recycling; MER – Materials for energy recovery; EEE – Exported electrical energy; EET – Exported thermal energy.											

WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
HWD	kg	1,17E-01	8,64E-03	1,10E-02	1,37E-01	MND	MNR	1,40E-03	6,50E-04	1,70E-04	1,80E-04	-7,49E-02
NHWD	kg	1,61E+00	3,43E-02	6,17E+02	6,18E+02	MND	MNR	3,92E-03	2,90E-03	6,22E-03	9,75E+01	-5,05E-01
RWD	kg	2,27E-01	4,30E-04	1,09E-02	2,38E-01	MND	MNR	2,28E-05	3,36E-05	2,59E-05	5,82E-05	-1,46E-01
Acronyms	HWD – Hazardous waste disposed; NHWD – Non-hazardous waste disposed; RWD – Radioactive waste disposed.											

ENVIRONMENTAL IMPACT DATA – OPTION 2 (LOW-CARBON)

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
GWP-Total	kg CO2 eq.	2,20E+03	9,36E+01	1,37E+03	3,66E+03	MND	MNR	1,59E+01	7,22E+00	3,37E+00	8,46E+01	-2,10E+03
GWP-fossil	kg CO2 eq.	2,27E+03	9,35E+01	1,36E+03	3,72E+03	MND	MNR	1,59E+01	7,21E+00	3,43E+00	3,82E+00	-2,04E+03
GWP-biogenic	kg CO2 eq.	-7,32E+01	7,04E-02	7,42E+00	-6,58E+01	MND	MNR	3,65E-03	6,60E-03	-5,91E-02	8,07E+01	-1,21E+01
GWP-LULUC	kg CO2 eq.	1,19E+00	4,76E-02	4,08E-01	1,64E+00	MND	MNR	1,79E-03	3,56E-03	2,81E-03	4,10E-03	-4,83E+01
ODP	kg CFC-11 eq.	5,06E-06	2,08E-06	6,53E-06	1,37E-05	MND	MNR	2,53E-07	1,57E-07	3,49E-08	4,40E-08	-6,13E-05
AP	mol H+ eq.	2,00E+01	3,60E-01	9,62E+00	2,99E+01	MND	MNR	1,47E-01	1,58E-02	3,19E-02	2,44E-02	-1,31E+01
EP-freshwater	kg P eq.	1,22E-01	6,78E-03	1,60E+00	1,73E+00	MND	MNR	4,90E-04	5,10E-04	2,97E-03	1,13E-03	-1,17E+00
EP-marine	kg N eq.	2,10E+00	9,42E-02	1,43E+00	3,62E+00	MND	MNR	6,83E-02	3,97E-03	5,75E-03	6,33E-03	-1,83E+00
EP-terrestrial	mol N eq.	2,28E+01	9,94E-01	1,22E+01	3,59E+01	MND	MNR	7,43E-01	4,04E-02	6,67E-02	6,75E-02	-1,66E+01
POCP	kg NMVOC eq.	7,15E+00	4,59E-01	4,55E+00	1,22E+01	MND	MNR	2,20E-01	2,45E-02	1,83E-02	2,23E-02	-7,22E+00
ADPE (disc.2)	kg Sb eq.	9,27E-04	1,80E-04	4,70E-04	1,58E-03	MND	MNR	3,08E-06	1,68E-05	4,43E-05	4,13E-06	-1,52E-03
ADPF (disc.2)	MJ, (NCV)	2,71E+04	1,41E+03	1,55E+04	4,40E+04	MND	MNR	2,10E+02	1,03E+02	3,89E+01	5,50E+01	-3,16E+04
WDP (disc.2)	m3 World eq.	7,67E+02	7,15E+00	2,88E+02	1,06E+03	MND	MNR	5,19E-01	5,12E-01	8,52E-01	6,79E-01	-4,03E+03
Acronyms	GWP-total – Climate change, total global warming potential; GWP-fossil – Climate change, fossil fuels; GWP-biogenic – Climate change, biogenic carbon; GWP-luluc – Climate change, land use and land use change; ODP – Ozone layer depletion; AP – Acidification of terrestrial and freshwater environments; EP-freshwater – Eutrophication, freshwater; EP-marine – Eutrophication, marine; EP-terrestrial – Eutrophication, terrestrial; POCP – Photochemical ozone formation (smog formation); ADPE – Abiotic depletion, minerals and metals; ADPF – Abiotic depletion, fossil fuels; WDP – Water scarcity (water use deprivation potential); NCV - net calorific value.											
Disclaimer 2	The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.											

Note: For aluminium castings produced using the same material composition and manufacturing technology, the A1–A3 impacts scale approximately with product mass. For Ref. 17650 this corresponds to an indicative GWP total emission intensity of 9.3 kg CO_2 eq per kg of product; this value is provided for information only and does not replace a product-specific LCA.

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
PM	Disease Incidence	1,27E-05	6,60E-06	1,68E-05	3,62E-05	MND	MNR	4,07E-06	4,29E-07	3,05E-07	3,74E-07	-1,40E-04
IRP (disc.1)	kBq U235 eq.	6,72E+01	1,79E+00	4,43E+01	1,13E+02	MND	MNR	9,88E-02	1,39E-01	1,05E-01	2,39E-01	-5,50E+02
ETP-fw (disc.2)	CTUe	1,65E+03	6,76E+02	4,10E+03	6,42E+03	MND	MNR	9,94E+01	5,05E+01	2,40E+01	8,07E+02	-8,15E+03
HTP-c (disc.2)	CTUh	7,51E-07	4,12E-08	4,16E-07	1,21E-06	MND	MNR	4,84E-09	3,23E-09	5,87E-09	3,39E-09	-6,49E-06
HTP-nc (disc.2)	CTUh	1,88E-06	8,40E-07	1,50E-05	1,78E-05	MND	MNR	3,04E-08	6,32E-08	1,22E-07	4,06E-08	-5,70E-05
SQP (disc.2)	Dimensionless	9,34E+03	1,31E+03	3,39E+03	1,40E+04	MND	MNR	1,40E+01	6,19E+01	2,48E+02	6,75E+01	-2,18E+03
Acronyms	PM – Particulate matter emissions (potential incidence of disease);IRP – Ionising radiation, human health exposure potential; ETP-fw – Ecotoxicity, freshwater; HTP-c – Human toxicity, cancer effects; HTP-nc – Human toxicity, non-cancer effects; SQP – Land use related impacts, soil quality.											
Disclaimer 1	This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possibe nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.											
Disclaimer 2	The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.											

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
PERE	MJ, (NCV)	3,17E+04	2,07E+01	1,41E+03	3,31E+04	MND	MNR	1,18E+00	1,61E+00	5,37E+00	3,68E+00	-1,27E+04
PERM	MJ, (NCV)	1,51E+03	0,00E+00	0,00E+00	1,51E+03	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ, (NCV)	3,32E+04	2,07E+01	1,41E+03	3,46E+04	MND	MNR	1,18E+00	1,61E+00	5,37E+00	3,68E+00	-1,27E+04
PENRE	MJ, (NCV)	2,63E+04	1,41E+03	1,55E+04	4,32E+04	MND	MNR	2,10E+02	1,03E+02	3,89E+01	5,50E+01	-3,16E+04
PENRM	MJ, (NCV)	8,19E+02	0,00E+00	0,00E+00	8,19E+02	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ, (NCV)	2,71E+04	1,41E+03	1,55E+04	4,40E+04	MND	MNR	2,10E+02	1,03E+02	3,89E+01	5,50E+01	-3,16E+04
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ, (NCV)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ, (NCV)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m3	7,92E+01	2,44E-01	4,08E+01	1,20E+02	MND	MNR	1,86E-02	1,69E-02	6,72E-02	4,61E-02	-1,02E+02
Acronyms	PERE – Use of renewable primary energy as energy carriers; PERM – Use of renewable primary energy resources as raw materials; PERT – Total use of renewable primary energy resources (PERE + PERM); PENRE – Use of non-renewable primary energy as energy carriers; PENRM – Use of non-renewable primary energy resources as raw materials; PENRT – Total use of non-renewable primary energy resources (PENRE + PENRM); SM – Use of secondary material; RSF – Use of renewable secondary fuels; NRSF – Use of non-renewable secondary fuels; FW – Net use of fresh water; NCV - net calorific value.											

OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	1,30E+01	1,30E+01	MND	MNR	0,00E+00	0,00E+00	2,93E+02	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MNR	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Acronyms	CRU – Components for re-use; MFR – Materials for recycling; MER – Materials for energy recovery; EEE – Exported electrical energy; EET – Exported thermal energy.											

WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4-A5	B1-B7	C1	C2	C3	C4	D
HWD	kg	9,35E-03	8,64E-03	1,10E-02	2,90E-02	MND	MNR	1,40E-03	6,50E-04	1,70E-04	1,80E-04	-7,49E-02
NHWD	kg	8,23E+02	3,43E-02	6,17E+02	1,44E+03	MND	MNR	3,92E-03	2,90E-03	6,22E-03	9,75E+01	-5,05E-01
RWD	kg	4,59E-01	4,30E-04	1,09E-02	4,71E-01	MND	MNR	2,28E-05	3,36E-05	2,59E-05	5,82E-05	-1,46E-01
Acronyms	HWD – Hazardous waste disposed; NHWD – Non-hazardous waste disposed; RWD – Radioactive waste disposed.											

SCENARIO DOCUMENTATION

Manufacturing energy scenario documentation

Scenario parameter	Value
Source and quality of electricity data	Emission Factors for Electricity in Poland reported in December 2025 by KOBiZE – the National Centre for Emissions Management in Poland
Electricity CO_2 / kWh	0.553 kg CO_2e / kWh
Source and quality of natural gas data	Background dataset for natural gas supply and combustion (European market mix) from ecoinvent v3.9.1
Natural gas modelling	Natural gas consumption in Module A3 is modelled as site-level gas use for furnace-related operations and allocated to the declared product using mass-based allocation

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Multicert Sp. z o.o. (current version). General Programme Instructions of the EPD Polska Programme. Warsaw, Poland.

EPD VERIFICATION:

The verification procedure of this Environmental Product Declaration (EPD) was carried out in accordance with ISO 14025. The EPD is valid for five years from the date of publication and may be updated earlier in case of significant changes. Renewal of validity requires review and, if necessary, updating.

EPD CONTRIBUTORS

Manufacturer representative	Hubert Puto, COO Executive Assistant
EPD verifier	Izabela Sztamberek-Sochan, Ph.D.

Note: The sole ownership, liability, and liability of this declaration are with the owner. Construction product declarations may not be comparable if they do not comply with EN 15804. For detailed information on comparability, please refer to EN 15804 and ISO 14025.

EPD POLSKA CERTIFICATE

Program EPD Polska
Operator: MULTICERT Sp. z o.o.

Thoni Alutec
Casting the future

CERTIFICATE

TYPE III EPD DECLARATION

(ENVIRONMENTAL PRODUCT DECLARATION)

Reg. No. EPD-P 01.02.2026

EPD Environmental Product Declaration
EPD VERIFIED
EPD POLAND

This document confirms that the Environmental Product Declaration developed by **Thoni Alutec Sp. z o.o.** for

Cast Aluminum Circuit Breaker Housing (ref. 17650) for Blue GIS Systems

manufactured in accordance with **EN 1706:2010, 1559-1:2010 and EN 62271-1 / IEC 62271-1** standards meets the requirements of standards **EN 15804:2012+A2:2019** and **ISO 14025**, and that the data contained therein has been prepared correctly.

The Declaration was published on February 18, 2026 and is valid until February 18, 2031, or until it is deregistered or its publication on the website www.epd.org.pl is discontinued.

Authenticity of this certificate can be confirmed in.
the public register at www.epd.org.pl

Izabela Sztamberek-Sochan, Ph.D.
EPD Polska Verifier

MULTICERT JEDNOSTKA CERTYFIKACYJNA

Grzegorz Suwara
CEO Multicert Sp. z o.o.

Warsaw, February 18, 2026