Statement of Verification

BREG EN EPD No: 000778 Issue: 01

This is to verify that the Environmental Product Declaration provided by:

Honeywell International Inc.

are in accordance with the requirements of:

EN 15804:2012+A2:2019

and

BRE Global Scheme Document SD207

This declaration is for:
1 Unit of Direct Drive VA Amplifier (585030-AMP 4XD125B weighing 9.17Kg/Unit, 585031-AMP 4XD250B weighing 12.4 Kg/Unit) for the service life of 12 years

Company Address

Novar GmbH a Honeywell Company
Berliner Straße 111
40880 Ratingen
Germany

Direct Drive VA Amplifier (585030-AMP 4XD125B)

Direct Drive VA Amplifier (585031-AMP 4XD250B)

Honeywell

Signed for BRE Global Limited	Hayley Thomson Operator	
20 March 2026 Date of this Issue	20 March 2026 Date of First Issue	19 March 2031 Expiry Date

BRE Global Verified EPD

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ECO PLATFORM EPD VERIFIED

Environmental Product Declaration

EPD Number: 000778

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE 2025 PCR (PN 514 Rev 3.2) Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A2:2019 EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems
Commissioner of LCA study	**LCA consultant/Tool**
Novar GmbH a Honeywell Company Berliner Straße 111 40880 Ratingen Germany	LCA Consultant: Sustainability Centre of Excellence, Honeywell Technology & Connected Solutions (HTCS) Madurai LCA Tool: BRE LINA A2
Declared/Functional Unit	**Applicability/Coverage**
1 Unit of Direct Drive VA Amplifier (585030-AMP 4XD125B weighing 9.17Kg/Unit, 585031-AMP 4XD250B weighing 12.4 Kg/Unit) for the service life of 12 years.	Product Specific
EPD Type	**Background database**
Cradle to Grave	ecoinvent 3.8

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR [a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☒Internal ☐ External
(Where appropriate [b]) Third party verifier: Kim Albury
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance

Information modules covered

Product			Construction		Use stage							End-of-life					Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building							
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑

Note: Ticks indicate the Information Modules declared.

Manufacturing site(s)

Honeywell's manufacturing facilities located in Lugoj, Romania.

Data Coverage Period: 01-01-2024 - 31-12-2024

Construction Product:

Product Description

Power amplifiers are used to amplify the audio signal and VARIODYN® ONE offers a range of Class D Power Amplifiers to provide you flexibility to choose an appropriate model as per your project's requirement. 4XD125B and 4XD250B are 4 channel amplifiers with inbuilt battery charger. They provide 125 W and 250 W per channel respectively.

All amplifier channels are independent from each other allowing use of any one channel as a backup. This could be for the other 3 channels or for amplifier channels in other amplifiers with the same or lower output power.

Two different Class D Power Amplifiers with inbuilt Battery Charger are:

Direct Drive VA Amplifier (585030-AMP 4XD125B)
4 Channel 125 W per Channel with inbuilt Battery Charger. The 1U 19-inch rack mountable direct drive 4 channel voice alarm amplifier unit provides 4 x 125 W power output. Each channel provides an independent 100 V audio output. The unit has an integral battery charger for charging 24 V lead-acid batteries of up to 65 Ah used to provide standby supply in the event of mains power failure. It is designed for direct integration and is fully compatible with VARIODYN® ONE system.

Direct Drive VA Amplifier (585031-AMP 4XD250B)
4 Channel 250 W per Channel with inbuilt Battery Charger. The 2U 19-inch rack mountable direct drive 4 channel voice alarm amplifier unit provides 4 x 250 W power output. Each channel provides an independent 100 V audio output. The unit has an integral battery charger for charging 24 V lead-acid batteries of up to 105 Ah used to provide standby supply in the event of mains power failure. It is designed for direct integration and is fully compatible with VARIODYN® ONE system.

Part Number	Description	Mass of the product (Kg)	Mass of the accessories included with the product (Kg)
585030	Direct Drive VA Amplifier- 4XD125B	9.05	0.12
585031	Direct Drive VA Amplifier- 4XD250B	12.28	0.12

Technical Information

All the technical information of the 4XD125B and 4XD250B amplifier is given in the technical datasheets:
Direct Drive VA Amplifier- 4XD125B- https://www.esser-systems.com/en/products/details/voice-alarm-system-variodynR-one/power-amplifier/585030-amp-4xd125b/
Direct Drive VA Amplifier- 4XD250B- https://www.esser-systems.com/en/products/details/voice-alarm-system-variodynR-one/power-amplifier/585031-amp-4xd250b/

Property	Direct Drive VA Amplifier- 4XD125B	Direct Drive VA Amplifier- 4XD250B
Channel separation	≥ 75 dB	≥ 75 dB
Distortion factor @ 1 kHz	≤ 0.3 %	≤ 0.3 %
Approval	EN 54-4 and EN 54-16	EN 54-4 and EN 54-16
Efficiency	< 80 %	< 80 %
Signal to noise ratio	≥ 90 dB (A)	≥ 90 dB (A)
Input level	0 dBu	0 dBu
Output power *8	4 x 125 W	4 x 250 W
Current (1 kHz sinus/1 min.) @ 24 V DC *7	26.5 A	53.5 A
Rated current @ 230 V AC *6	1.13 A	2.2 A
Rated current @ 24 V DC*6	9.44 A	18.6 A
Technology	Class D	Class D
Rated voltage	230 V AC, +10 %/-5 %	230 V AC, +10 %/-5 %
Transmission range	50 Hz ... 60 Hz	50 Hz ... 60 Hz
System input impedance	20 kOhm	20 kOhm
Ambient temperature	-5 °C ... 55 °C	-5 °C ... 55 °C
Storage temperature	55 °C ... -10 °C	55 °C ... -10 °C
Air humidity	< 93 % (non-condensing)	< 93 % (non-condensing)
Dimensions	W: 483 mm H: 44 mm D: 400 mm (1HU)	W: 483 mm H: 90 mm D: 402 mm (2 HU)
Emergency power supply	21.5 V DC … 28.5 V DC	21.5 V DC … 28.5 V DC

Direct Drive VA Amplifier (585030-AMP 4XD125B)

Direct Drive VA Amplifier (585031-AMP 4XD250B)

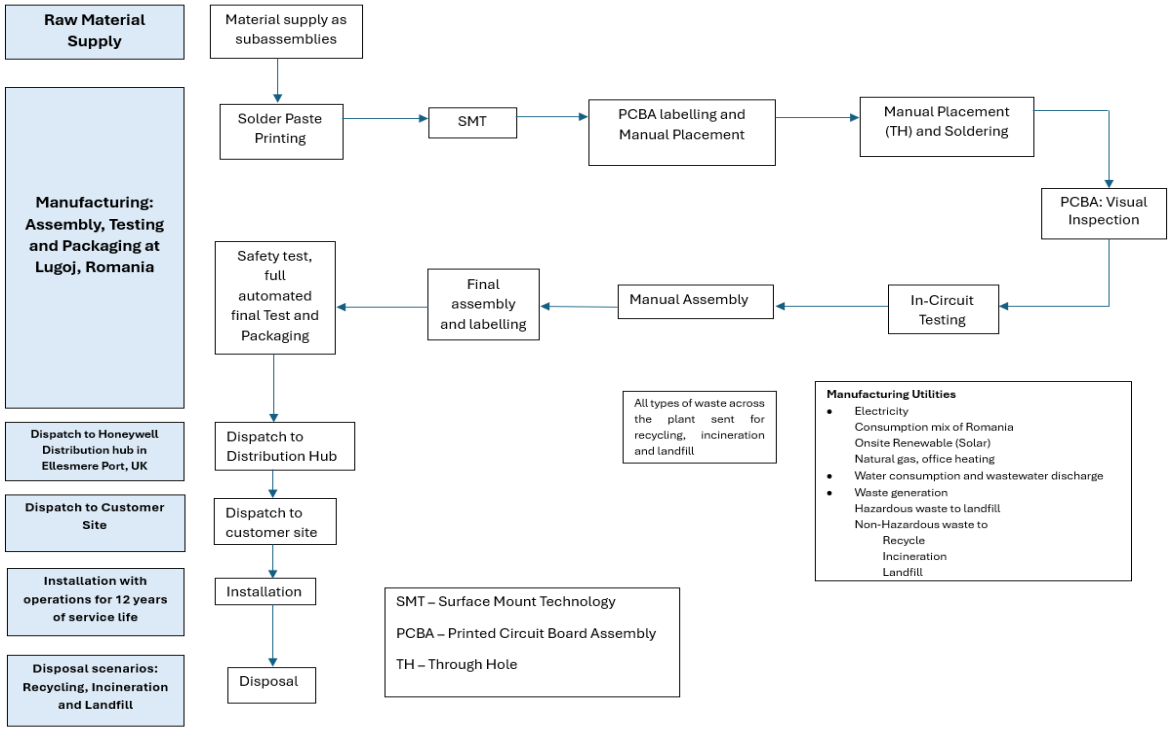
Main Product Content

Material/Chemical Input	Direct Drive VA Amplifier-4XD125B	Direct Drive VA Amplifier-4XD250B
Aluminium	3.78%	3.37%
Brass	0.95%	1.16%
Cable	1.86%	2.53%
Electronics	42.74%	41.16%
Packaging	6.42%	5.92%
Copper	0.75%	0.66%
Plastics	1.66%	1.05%
Paper	0.22%	0.01%
Silicone	0.22%	0.12%
Steel	41.39%	44.03%

Manufacturing Process

The manufacturing process at Honeywell's Lugoj factory involves assembly process. Various subassemblies, parts, and components are sourced from regional and global suppliers and assembled at the factory following sophisticated technology and standard industrial practices, with robust inspection and testing. The process flow diagram of the assembly process is provided above. During the assembly process, there is no multi-output generation on the production lines. The factory utilities used for the production are the electricity mix which consists of both Romania grid mix and Onsite renewable (solar) electricity, Natural gas, Industrial furnace and Water. The production waste at the time of manufacturing which consists of Hazardous and Non-hazardous wastes are also considered in the process flow. which All products are assembled using the same technology and process which works on standard industrial practices and all the products are inline quality tested. A set of representative products from every batch gets tested at the laboratory to ensure the product compliance with regulations and certifications.

Process Flow Diagram



Construction Installation

The installation phase involves only manual activities and does not consume any energy or water to install the product. After installation, the packaging waste generated onsite is taken to the nearest incineration facility for disposal assuming a transport distance of 100 km based on the PSR-0019-ed1EN-2023 06 06. It is assumed that there is no wastage/damage occurred while downstream transportation or installation of the products at the customer location.

Use Information

This electricity consumption in use phase is calculated based on PSR-0019 ed1EN-2023 06 06 PEP Eco passport.

According to the PSR-0019 ed1 EN-2023 06 06 PEP ecopassport® guideline, the electricity consumption during 10-minute alarm state is negligible over the annual operating hours (8760 hours).

The current consumption of the amplifiers in Standy mode:
Direct Drive VA Amplifier (585030-AMP 4XD125B) current consumption from 230V AC mains power =0.3A
Direct Drive VA Amplifier (585031-AMP 4XD250B) current consumption from 230V AC mains power = 0.38A

The total power consumed per annum is calculated using the formula below
Ct = Pc * (8760) h/an* DVR

where Ct: Total energy consumption (kWh), Pc: Power consumption in quiescent condition (W), an: annual, DVR: Dynamic voltage restorer is assumed as 1.

Direct Drive VA Amplifier (585030-AMP 4XD125B)
= 0.3*230*24*365*12
= 7253.280 KWh
= 26111.808 MJ

Direct Drive VA Amplifier (585031-AMP 4XD250B)
=0.38*230*24*365*12
=9187.488 KWh
= 33074.9568 MJ.

End-of-Life

100% of the product is recovered at the EOL. No additional input materials, energy or water required to dismantle the product at end of life of the product. It can be dismantled using standard equipment and tools by manual operation. Hence module C1 did not have any environmental impacts.

In case of C2, a typical transport distance of 100 km by road using a lorry > 32 metric tons from the demolition site to the waste processing plant is assumed. However, end-users of the EPD can use this information to calculate the impacts of bespoke transport distances if required.

The product consists of 55-60% Metal ,30-33% electronics, and 5-7% Plastics, Rubber and Paper. The most appropriate end-of-life scenario has been selected by referencing EN50693:2019 PCR recommendations. The End-of-life specific allocation rules in C3 for materials to recycling, incineration, and disposal in landfills, C4 for all products in the family are considered as given below.

Referencing to EN50693:2019 PCR, the allocation for end-of-life scenarios is assumed are given below.

Material	Recycling	Incineration	Disposal in landfill
Steel	80%	NA	20%
Plastics	NA	50%	50%
Rubber	NA	50%	50%
PCB (Metals)	NA	NA	100%
Paper	NA	100%	NA
Aluminium	70%	NA	30%

Copper	60%	NA	40%
Polyethylene	NA	50%	50%
Brass	60%	NA	40%

The allocation of environmental burden of waste recycling or reuse shall be assigned to the product system generating the waste and the waste comes as burden free and accounted in Module D.
In addition, the benefits of Module D include the energy credits from incineration of waste product at end-of-life. Non-combustible contents have been excluded and only the remaining combustible content (plastics and rubber) are accounted for in Module D energy recovery calculations.

Life Cycle Assessment Calculation Rules

Declared / Functional unit description

1 Unit of Direct Drive VA Amplifier (585030-AMP 4XD125B weighing 9.17Kg/Unit, 585031-AMP 4XD250B weighing 12.4 Kg/Unit) for the service life of 12 years.

System boundary

The system boundary considered in the LCA study is cradle to grave which covers all production stages (A1-A3), transportation to site (A4), installation (A5), use stages (B1-B7), and end- of-life stages (C1-C4 and D) in accordance with EN 15804:2012+A2:2019. Additionally, this EPD complies with EN 50693:2019 PCR for the evaluation of electronic and electrical products and systems. The LCA study also complies with BRE 2025 Product Category Rules (PN 514 Rev 3.2).

The study period of this LCA is 12 years which is same as the reference service life of the product for the entire system boundary from A1-C4. The accessories provided along with the product is also included in the LCA study. The 24 V lead acid batteries required by the amplifiers to work in the standby mode due to power failure is not included in the study. Impacts and losses/wastage in production, transport, use stage and end of life stage are accounted in their respective modules.

LCA is completed for both the products. (Direct Drive VA Amplifier-585030-AMP 4XD125B and Direct Drive VA Amplifier 585031-AMP 4XD250B).

Data sources, quality and allocation

Specific primary data and secondary data for the manufacturing of Direct Drive VA Amplifier (585030-AMP 4XD125B) and Direct Drive VA Amplifier (585031-AMP 4XD250B) for the VARIODYN ONE PA/VA Voice alarm system in Honeywell factory Lugoj have been modelled using BRE LINA A2. The manufacturer-specific data for the production period for the study is 1-January-2024 to 31-December-2024. In accordance with requirements of EN15804, the most current available data has been used. The main sources for primary data are the Bill of Materials (BOM) and technical drawings, while site specific foreground data are provided by Honeywell HSE Facility Management. For all secondary data, obtained for all other upstream and downstream processes that are beyond the control of the manufacturer (i.e. raw material production), are generic data originating from Ecoinvent 3.8. All datasets are complete within the context used and conform to the system boundary and the criteria for the exclusion of inputs and outputs, according to the requirements specified in EN 15804:2012+A2:2019.The factory also produces other products in addition to the Direct Drive VA Amplifiers, therefore the grid electricity, natural gas, water and waste generated have been allocated to all products by unit volume according to the provisions in the BRE 2023 PCR (PN 514 Rev 3.1) and EN 15804:2012+A2:2019. The electricity consumption per product arrived based on allocation of the overall factory energy consumption to production volume based on one year data. Site wide values for energy, water and wastewater have been taken from Honeywell ERP systems. The factory has onsite solar energy generation facility for 1.7MWp PV panels having a utilization rate of 28.3% for factory operations. Figures for the raw materials, ancillary materials and packaging are from actual usages. Emissions to air, water and soil during assembly process are negligible and hence not accounted. All the primary data such as BOM, energy consumption, supply chain details, are clearly mapped to the corresponding processes and the most specific datasets.

The LCIA methodology used is the EN 15804:2012+A2:2019 based on Environmental Footprint 3.1. Specific regional datasets are used in this LCA. The geographical scope of product is Modules A1-A3: Romania, A4-A5: Region Europe, Module B: Region Europe and Module C: Region Europe are considered for geography. There is less than 1 year difference between the LCI reference year (2024) and the time period for which the LCA (2024-2025) is undertaken. Hence the quality of geographical and technical representativeness is therefore very good. Romanian consumption mix was used for electricity with an emissions factor of 0.431 kg CO_2eq /kWh. This is based on located-based approach. Romanian Natural gas data (for facility discrete heat) was used with an emissions factor of 0.074 kg CO_2eq /kWh and Solar electricity Romania (from multi-Si panel) of 0.076 kg CO_2eq /kWh.

In the end-of-life allocation, substitution approach has been applied. This allocation approach is based on the perspective that a material that is recycled into a secondary material at end of life will substitute another material based on technical substitutability. Hence, a credit is given to account for the material substitution based on mass or average grid energy. The allocation percentage for end of life for the WEEE products are considered based on EN50693:2019 PCR recommendations.
Assumptions considered in the LCA Study:
1. The Power Supply Unit present in the amplifiers is modelled based on the dataset Power Supply Unit for Desktop computers in the Ecoinvent 3.8 database (ST-235ATX).
2. Regional / Global datasets are used where specific data are unavailable
3. Scraps for metal working and plastic processes are cut off as they are included in the secondary datasets.
4. Surface treatments like plating, galvanizing is accounted in the secondary datasets.
5. Onsite solar generation data is considered in the LCA model
6. Volume based allocation is done across all products based on the production volumes
7. Emissions to air, water and soil during assembly process are negligible and hence not accounted.
8. In the EoL, Brass is modelled using copper datasets.

ISO14044 guidance Quality Level	Geographical representativeness	Technical representativeness	Time representativeness
Very good	Data from area under study.	Data from processes and products under study. Same state of technology applied as defined in goal and scope (i.e., identical technology).	Less than 1-year difference between the reference year according to the documentation, and the time period for which data are representative

Cut-off criteria

The LCA study includes input and output flows at every process steps. Life cycle inventory data related to raw material, packaging, consumables, transportation, process energy consumption, water use and waste generation are considered. No relevant processes are excluded. The upstream data related to raw material extraction and processing are factored through background datasets with Ecoinvent following standard industrial practice.

LCA Results Summary

Part No	Product Description	B6-Operational energy use during service life of 12 years (kWh)	Cradle to Gate (kg CO_2eq)	Cradle to Grave (kg CO_2eq) (Reference only)
585030	Direct Drive VA Amplifier-4XD125B	7253.28	475.22	3350.39
585031	Direct Drive VA Amplifier-4XD250B	9187.49	549.95	4196.78

LCA Results of Direct Drive VA Amplifier (585030-AMP 4XD125B)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	4.47E+02	4.44E+02	2.41E+00	7.66E-01	3.72E-05	4.23E+00	6.27E-01
	Transport	A2	2.77E+01	2.77E+01	9.30E-03	1.90E-03	6.30E-06	1.42E-01	4.06E-04
	Manufacturing	A3	5.19E-01	7.21E-01	-2.10E-01	3.77E-03	7.25E-08	3.97E-03	6.00E-04
	Total (Consumption grid)	A1-3	4.76E+02	4.72E+02	2.21E+00	7.72E-01	4.36E-05	4.38E+00	6.28E-01
Construction process stage	Transport	A4	3.01E+00	3.01E+00	2.64E-03	1.16E-03	7.01E-07	1.23E-02	1.92E-04
	Construction	A5	1.00E+00	1.47E-02	9.89E-01	1.30E-05	4.43E-09	2.64E-04	4.06E-06
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	2.87E+03	2.77E+03	9.14E+01	6.58E+00	1.38E-04	1.49E+01	2.78E+00
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
39% Recycle, 1% Incineration, 59% Landfill									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	8.33E-02	8.32E-02	8.09E-05	2.99E-05	1.99E-08	3.47E-04	5.18E-06
	Waste processing	C3	4.66E-01	4.30E-01	3.51E-02	1.37E-04	4.61E-08	2.34E-03	2.72E-05
	Disposal	C4	6.14E-01	6.13E-01	5.75E-04	6.07E-05	1.68E-08	4.96E-04	1.88E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-9.11E+00	-9.13E+00	2.51E-02	-8.03E-03	-3.30E-07	-8.26E-02	-6.08E-03

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results of Direct Drive VA Amplifier (585030-AMP 4XD125B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral& metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	6.57E-01	7.18E+00	2.13E+00	1.83E-01	5.71E+03	1.76E+02	2.27E-05
	Transport	A2	5.17E-02	5.66E-01	1.48E-01	9.17E-06	3.89E+02	5.15E-01	3.80E-07
	Manufacturing	A3	1.72E-03	1.01E-02	2.26E-03	4.45E-06	1.10E+01	4.84E-01	4.87E-08
	Total (Consumption grid)	A1-3	7.10E-01	7.76E+00	2.28E+00	1.83E-01	6.11E+03	1.77E+02	2.31E-05
Construction process stage	Transport	A4	3.71E-03	4.06E-02	1.26E-02	9.67E-06	4.58E+01	2.10E-01	2.80E-07
	Construction	A5	1.28E-04	1.27E-03	3.28E-04	1.08E-07	1.47E-01	2.00E-02	1.99E-09
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	2.60E+00	2.26E+01	6.16E+00	2.78E-03	5.98E+04	1.99E+03	4.41E-05
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
39% Recycle, 1% Incineration, 59% Landfill									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.06E-04	1.16E-03	3.73E-04	1.91E-07	1.30E+00	6.27E-03	9.79E-09
	Waste processing	C3	9.54E-04	1.04E-02	2.86E-03	3.32E-06	3.22E+00	3.01E-02	5.78E-08
	Disposal	C4	2.01E-02	1.83E-03	6.44E-04	1.94E-07	1.31E+00	5.83E-02	9.53E-09
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.02E-02	-1.14E-01	-4.25E-02	-9.52E-04	-8.97E+01	-1.45E+00	-7.28E-07

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results of Direct Drive VA Amplifier (585030-AMP 4XD125B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts

			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	4.88E+01	4.36E+04	4.59E-07	1.90E-05	2.15E+03
	Transport	A2	1.75E+00	2.12E+02	2.77E-09	3.41E-07	6.48E+01
	Manufacturing	A3	1.80E-01	1.24E+01	3.72E-10	1.01E-08	2.62E+01
	Total (Consumption grid)	A1-3	5.07E+01	4.39E+04	4.62E-07	1.93E-05	2.24E+03
Construction process stage	Transport	A4	2.35E-01	3.57E+01	1.12E-09	3.79E-08	3.62E+01
	Construction	A5	1.09E-03	1.57E+00	2.18E-10	1.43E-09	4.69E-02
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	1.64E+03	2.95E+04	7.11E-07	2.38E-05	8.62E+03
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
39% Recycle, 1% Incineration, 59% Landfill							
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	6.56E-03	1.01E+00	2.80E-11	1.11E-09	1.48E+00
	Waste processing	C3	1.74E-02	3.59E+00	1.35E-10	3.92E-09	9.12E-01
	Disposal	C4	6.29E-03	7.46E+01	1.60E-09	1.08E-07	3.04E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.47E-01	-5.50E+02	-3.40E-08	-7.03E-07	-2.97E+01

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results of Direct Drive VA Amplifier (585030-AMP 4XD125B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy

			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	6.14E+02	3.03E-01	6.14E+02	5.04E+03	6.50E+02	5.69E+03
	Transport	A2	1.19E+03	0.00E+00	1.19E+03	3.66E+05	0.00E+00	3.66E+05
	Manufacturing	A3	-1.27E+00	8.04E+00	6.77E+00	1.06E+01	7.92E-02	1.07E+01
	Total (Consumption grid)	A1-3	1.80E+03	8.34E+00	1.81E+03	3.71E+05	6.50E+02	3.72E+05
Construction process stage	Transport	A4	6.31E-01	0.00E+00	6.31E-01	4.50E+01	0.00E+00	4.50E+01
	Construction	A5	3.60E-05	0.00E+00	3.60E-05	2.78E-03	0.00E+00	2.78E-03
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	1.06E+04	0.00E+00	1.06E+04	6.05E+04	0.00E+00	6.05E+04
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
39% Recycle, 1% Incineration, 59% Landfill								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.65E-02	0.00E+00	1.65E-02	1.27E+00	0.00E+00	1.27E+00
	Waste processing	C3	6.57E-02	0.00E+00	6.57E-02	1.03E-01	2.84E+00	2.94E+00
	Disposal	C4	2.69E-02	0.00E+00	2.69E-02	-1.53E+02	1.55E+02	1.29E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-5.12E+00	0.00E+00	-5.12E+00	-8.79E+01	0.00E+00	-8.79E+01

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resource

LCA Results of Direct Drive VA Amplifier (585030-AMP 4XD125B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	1.80E+00	0.00E+00	0.00E+00	3.96E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	1.27E-02
	Manufacturing	A3	6.20E-01	0.00E+00	0.00E+00	1.22E-02
	Total (Consumption grid)	A1-3	2.42E+00	0.00E+00	0.00E+00	3.98E+00
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	5.18E-03
	Construction	A5	0.00E+00	0.00E+00	0.00E+00	4.73E-04
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	0.00E+00	0.00E+00	0.00E+00	5.08E+01
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00
39% Recycle, 1% Incineration, 59% Landfill						
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	1.54E-04
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	7.28E-04
	Disposal	C4	7.20E-06	0.00E+00	0.00E+00	1.37E-03
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.43E-02	0.00E+00	0.00E+00	-3.68E-02

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results of Direct Drive VA Amplifier (585030-AMP 4XD125B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	4.56E+01	1.27E+03	1.69E-02
	Transport	A2	1.27E-01	1.85E+00	1.05E+02
	Manufacturing	A3	3.05E-02	2.36E+00	5.93E-05
	Total (Consumption grid)	A1-3	4.58E+01	1.27E+03	1.05E+02
Construction process stage	Transport	A4	5.00E-02	8.83E-01	6.95E+01
	Construction	A5	2.98E-06	5.18E-05	1.90E-02
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	2.11E+02	1.36E+04	4.41E-01
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00
39% Recycle, 1% Incineration, 59% Landfill					
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.37E-03	2.38E-02	8.69E+00
	Waste processing	C3	1.23E-02	2.41E-01	1.91E-05
	Disposal	C4	7.05E-02	2.49E-01	7.75E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.40E+00	-2.47E+01	-1.02E-04

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results of Direct Drive VA Amplifier (585030-AMP 4XD125B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life

			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	6.63E-04	6.28E-06	0.00E+00	0.00E+00	9.88E-03
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E-05
	Total (Consumption grid)	A1-3	0.00E+00	6.63E-04	6.28E-06	0.00E+00	0.00E+00	9.90E-03
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Construction	A5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
39% Recycle, 1% Incineration, 59% Landfill								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	0.00E+00	7.86E-02	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

LCA Results of Direct Drive VA Amplifier (585031-AMP 4XD250B)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	4.97E+02	4.93E+02	2.77E+00	8.51E-01	4.09E-05	4.50E+00	6.85E-01
	Transport	A2	5.24E+01	5.24E+01	1.73E-02	3.46E-03	1.19E-05	2.70E-01	7.48E-04
	Manufacturing	A3	5.47E-01	7.97E-01	-2.61E-01	4.64E-03	8.67E-08	4.26E-03	5.63E-04
	Total (Consumption grid)	A1-3	5.50E+02	5.46E+02	2.52E+00	8.59E-01	5.29E-05	4.77E+00	6.87E-01
Construction process stage	Transport	A4	4.07E+00	4.07E+00	3.57E-03	1.57E-03	9.48E-07	1.66E-02	2.60E-04
	Construction	A5	1.25E+00	2.50E-02	1.22E+00	1.85E-05	7.12E-09	3.56E-04	5.46E-06
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	3.64E+03	3.51E+03	1.16E+02	8.34E+00	1.75E-04	1.89E+01	3.52E+00
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
41% Recycle, 1% Incineration, 58% Landfill									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.13E-01	1.13E-01	1.09E-04	4.05E-05	2.69E-08	4.70E-04	7.01E-06
	Waste processing	C3	6.01E-01	5.68E-01	3.28E-02	1.67E-04	6.43E-08	3.26E-03	3.39E-05
	Disposal	C4	8.04E-01	8.03E-01	7.49E-04	7.93E-05	2.20E-08	6.49E-04	2.46E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.18E+01	-1.18E+01	3.31E-02	-9.79E-03	-4.30E-07	-9.99E-02	-7.46E-03

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results of Direct Drive VA Amplifier (585031-AMP 4XD250B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts

			EP-marine	EP-terrestrial	POCP	ADP-mineral&metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	7.21E-01	7.86E+00	2.36E+00	1.99E-01	6.34E+03	1.94E+02	2.40E-05
	Transport	A2	9.83E-02	1.08E+00	2.80E-01	1.65E-05	7.37E+02	9.49E-01	6.72E-07
	Manufacturing	A3	2.02E-03	1.19E-02	2.60E-03	4.57E-06	1.19E+01	5.15E-01	5.85E-08
	Total (Consumption grid)	A1-3	8.21E-01	8.95E+00	2.64E+00	1.99E-01	7.09E+03	1.95E+02	2.47E-05
Construction process stage	Transport	A4	5.02E-03	5.48E-02	1.70E-02	1.31E-05	6.19E+01	2.83E-01	3.79E-07
	Construction	A5	1.68E-04	1.67E-03	4.37E-04	1.49E-07	2.89E-01	2.53E-02	3.27E-09
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	3.29E+00	2.86E+01	7.81E+00	3.52E-03	7.57E+04	2.53E+03	5.59E-05
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
41% Recycle, 1% Incineration, 58% Landfill									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.43E-04	1.57E-03	5.04E-04	2.58E-07	1.75E+00	8.47E-03	1.32E-08
	Waste processing	C3	1.34E-03	1.46E-02	4.02E-03	3.99E-06	4.45E+00	3.79E-02	8.12E-08
	Disposal	C4	2.63E-02	2.40E-03	8.44E-04	2.53E-07	1.72E+00	7.66E-02	1.25E-08
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.29E-02	-1.43E-01	-5.52E-02	-1.08E-03	-1.16E+02	-1.76E+00	-9.31E-07

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results of Direct Drive VA Amplifier (585031-AMP 4XD250B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts

			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	5.13E+01	4.57E+04	5.11E-07	2.08E-05	2.29E+03
	Transport	A2	3.31E+00	3.99E+02	5.14E-09	6.46E-07	1.16E+02
	Manufacturing	A3	1.58E-01	1.44E+01	4.22E-10	1.06E-08	3.23E+01
	Total (Consumption grid)	A1-3	5.48E+01	4.61E+04	5.16E-07	2.14E-05	2.44E+03
Construction process stage	Transport	A4	3.17E-01	4.83E+01	1.51E-09	5.12E-08	4.90E+01
	Construction	A5	1.89E-03	2.03E+00	2.72E-10	1.86E-09	1.80E-01
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	2.08E+03	3.74E+04	9.01E-07	3.01E-05	1.09E+04
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
41% Recycle, 1% Incineration, 58% Landfill							
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	8.87E-03	1.37E+00	3.79E-11	1.50E-09	2.01E+00
	Waste processing	C3	2.35E-02	4.70E+00	1.74E-10	4.95E-09	1.16E+00
	Disposal	C4	8.23E-03	8.97E+01	1.83E-09	1.23E-07	3.99E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.88E-01	-6.68E+02	-4.55E-08	-8.29E-07	-3.64E+01

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results of Direct Drive VA Amplifier (585031-AMP 4XD250B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy

			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	6.80E+02	3.03E-01	6.80E+02	5.33E+03	9.90E+02	6.32E+03
	Transport	A2	2.27E+03	0.00E+00	2.27E+03	7.00E+05	0.00E+00	7.00E+05
	Manufacturing	A3	-2.28E+00	9.95E+00	7.67E+00	1.14E+01	9.12E-02	1.15E+01
	Total (Consumption grid)	A1-3	2.95E+03	1.03E+01	2.96E+03	7.05E+05	9.90E+02	7.06E+05
Construction process stage	Transport	A4	8.53E-01	0.00E+00	8.53E-01	6.08E+01	0.00E+00	6.08E+01
	Construction	A5	1.40E-03	0.00E+00	1.40E-03	1.08E-01	0.00E+00	1.08E-01
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	1.35E+04	0.00E+00	1.35E+04	7.66E+04	0.00E+00	7.66E+04
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
41% Recycle, 1% Incineration, 58% Landfill								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	2.23E-02	0.00E+00	2.23E-02	1.72E+00	0.00E+00	1.72E+00
	Waste processing	C3	8.18E-02	0.00E+00	8.18E-02	9.04E-01	3.19E+00	4.10E+00
	Disposal	C4	3.49E-02	0.00E+00	3.49E-02	-2.01E+02	2.03E+02	1.69E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-6.19E+00	0.00E+00	-6.19E+00	-1.14E+02	0.00E+00	-1.14E+02

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;
PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resource

LCA Results of Direct Drive VA Amplifier (585031-AMP 4XD250B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	2.26E+00	0.00E+00	0.00E+00	4.17E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	2.35E-02
	Manufacturing	A3	7.68E-01	0.00E+00	0.00E+00	1.27E-02
	Total (Consumption grid)	A1-3	3.03E+00	0.00E+00	0.00E+00	4.20E+00
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	7.01E-03
	Construction	A5	0.00E+00	0.00E+00	0.00E+00	5.98E-04
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	0.00E+00	0.00E+00	0.00E+00	6.44E+01
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00
41% Recycle, 1% Incineration, 58% Landfill						
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	2.09E-04
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	9.18E-04
	Disposal	C4	8.48E-06	0.00E+00	0.00E+00	1.80E-03
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.75E-02	0.00E+00	0.00E+00	-4.47E-02

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results of Direct Drive VA Amplifier (585031-AMP 4XD250B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	5.19E+01	1.47E+03	1.86E-02
	Transport	A2	2.36E-01	3.41E+00	5.22E-03
	Manufacturing	A3	3.52E-02	2.06E+00	5.34E-05
	Total (Consumption grid)	A1-3	5.21E+01	1.47E+03	2.39E-02
Construction process stage	Transport	A4	6.76E-02	1.19E+00	4.19E-04
	Construction	A5	1.16E-04	2.02E-03	7.47E-07
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00
	Repair	B3	0.00E+00	0.00E+00	0.00E+00
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00
	Operational energy use	B6	2.67E+02	1.72E+04	5.59E-01
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00
14% Recycle, 29% Incineration, 57% Landfill					
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.85E-03	3.21E-02	1.19E-05
	Waste processing	C3	1.51E-02	2.87E-01	2.70E-05
	Disposal	C4	8.07E-02	2.95E-01	1.02E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.76E+00	-3.08E+01	-1.37E-04

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results of Direct Drive VA Amplifier (585031-AMP 4XD250B), continued

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life

			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0.00E+00	9.96E-04	1.08E-05	0.00E+00	0.00E+00	9.88E-03
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-05
	Total (Consumption grid)	A1-3	0.00E+00	9.96E-04	1.08E-05	0.00E+00	0.00E+00	9.89E-03
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Construction	A5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use stage	Use	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Maintenance	B2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MNR	MNR
	Repair	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MNR	MNR
	Replacement	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MNR	MNR
	Refurbishment	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MNR	MNR
	Operational energy use	B6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Operational water use	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
14% Recycle, 29% Incineration, 57% Landfill								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	0.00E+00	9.45E-02	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

Scenarios and additional technical information

Scenarios and additional technical information				
Scenario	Parameter		Units	Results
A4 – Transport to the building site	Transportation of finished product to customer location to building site (A4) is by road transport from Lugoj to Neuss, Germany which is a distribution centre is assumed to be by Lorry, > 32 metric ton for a distance of 1537 km. From the distribution centre, the product gets transported to several customer locations throughout Europe. Hence, approximate diagonal distance 800 km is taken in the model for calculations of impacts related to downstream transport. During this transportation, it is assumed that all 100% utilization of products and none of them is accounted for any losses in distribution and installation phase.			
	Fuel type / Vehicle type		Diesel	Lorry, > 32 metric tonne
	Distance: From Factory to Distribution Centre		km	1537
	Distance: From Distribution Centre to Customer		km	800
	Capacity utilisation (incl. empty returns)		%	NA
	Bulk density of transported products		kg/m^3	NA
A5 – Installation in the building	The installation phase involves only manual activities and does not consume any energy or water to install the product. After installation, the packaging waste generated onsite is taken to the nearest incineration facility for disposal assuming a transport distance of 100 km based on the PSR-0019-ed1EN-2023 06 06. It is assumed that there is no wastage/damage occurred while downstream transportation or installation of the products at the customer location.			
	Product	Packaging waste	Disposal type	Unit	Disposed weight
	585030-Direct Drive VA Amplifier- 4XD125B	Cardboard	Incineration	kg	0.63
	585031-Direct Drive VA Amplifier- 4XD250B	Cardboard	Incineration	kg	0.78
B1 - Use	N/A There is no use during the service life of the product.			
B2 – Maintenance	The LCA study assumes that there is no maintenance activity needed during the 12 years of service life of the product.			
	No of maintenance cycles		Per year	0
B3 – Repair	N/A - There is no repair work needed during the service life of the products.			
B4 – Replacement	N/A -There is no replacement activity needed for the products during its service life.			
B5 – Refurbishment	N/A -There is no refurbishment activity needed for the products during its service life.			
Reference service life	12 years			

Scenarios and additional technical information

Scenario	Parameter	Units	Results
B6 – Use of energy;	This electricity consumption in use phase is calculated based on PSR-0019 ed1EN-2023 06 06 PEP Eco passport. According to the PSR-0019 ed1 EN-2023 06 06 PEP ecopassport® guideline, the electricity consumption during 10-minute alarm state is negligible over the annual operating hours (8760 hours). The current consumption of the amplifiers in Standy mode: Direct Drive VA Amplifier (585030-AMP 4XD125B) current consumption from 230V AC mains power =0.3A Direct Drive VA Amplifier (585031-AMP 4XD250B) current consumption from 230V AC mains power = 0.38A The total power consumed per annum is calculated using the formula below Ct = Pc * (8760) h/an* DVR where Ct: Total energy consumption (kWh), Pc : Power consumption in quiescent condition (kW), an : annual, DVR: Dynamic voltage restorer is assumed as 1. Direct Drive VA Amplifier (585030-AMP 4XD125B) = 0.3*230*24*365*12 = 7253.280 KWh **= 26111.808 MJ** Direct Drive VA Amplifier (585031-AMP 4XD250B) = 0.38*230*24*365*12 = 9187.488 KWh **= 33074.9568 MJ**		
B7 – Use of water	N/A There is no water usage associated with the products.		
C1 - Deconstruction	100% of the product is recovered at the EOL. No additional input materials, energy or water required to dismantle the product at end of life of the product. It can be dismantled using standard equipment and tools by manual operation. Hence module C1 did not have any environmental impacts.		
C2 – Transportation	A typical transport distance of 100 km by road using a lorry > 32 metric tons from the demolition site to the waste processing plant is assumed. However, end-users of the EPD can use this information to calculate the impacts of bespoke transport distances if required.	Diesel	Lorry > 32 metric tons
	Distance	km	100
C3 - Waste processing	The product consists of 55-60% Metal ,30-33% electronics, and 5-7% Plastics, Rubber and Paper. The most appropriate end-of-life scenario has been selected by referencing EN50693:2019 PCR recommendations. The End-of-life specific allocation rules in C3 for materials to recycling, incineration, and disposal in landfills, C4 for all products in the family are considered as given below.		
	Scenario: 39% Recycle, 1% Incineration	Product: Direct Drive VA Amplifier (585030-AMP 4XD125B)	Recycle, kg: 3.61 / Incineration, kg: 0.11
	Scenario: 41% Recycle, 1% Incineration	Product: Direct Drive VA Amplifier (585031-AMP 4XD250B)	Recycle, kg: 5.07 / Incineration, kg: 0.13
C4 - End of life,	Wastes that are not recycled at the waste processing facility will end up in landfill. For landfilling of waste, the environmental burden of landfilling and capturing and combustion of landfill gas, if any, is assigned to C4		

Scenarios and additional technical information				
Scenario	Parameter		Units	Results
	Scenario	Product		
	Raw material waste to 59% Landfill	Direct Drive VA Amplifier (585030-AMP 4XD125B)	kg	5.46
	Raw material waste to 58% Landfill	Direct Drive VA Amplifier (585031-AMP 4XD250B)	kg	7.21
Module D	The secondary material input is taken from ecoinvent 3.8. By checking the background dataset for the metals Aluminium, Steel, Copper and Brass there is recycled content contained in the A1 raw material. The recycled content values are.			
	Products Recycled Content (post-consumer)		kg	Quantity
	Recovered for recycling	Direct Drive VA Amplifier (585030-AMP 4XD125B)	kg	2.75
		Direct Drive VA Amplifier (585031-AMP 4XD250B)	kg	3.87
	Recovered for re-use	Direct Drive VA Amplifier (585030-AMP 4XD125B)	kg	0
		Direct Drive VA Amplifier (585031-AMP 4XD250B)	kg	0
	Recovered for energy	Direct Drive VA Amplifier (585030-AMP 4XD125B)	kg	0.09
		Direct Drive VA Amplifier (585031-AMP 4XD250B)	kg	0.10

Summary, Comments and Additional Information

Substances Assessment

Official declaration of Direct Drive Amplifiers states compliance with the requirements of the EU Directive 2011/65/EU amended by 2015/863/EU, on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 3). While the product do contain components with lead in concentrations above 0.1 % (w/w), which is a REACH SVHC included on the Candidate List.

Interpretation of Results

Global Warming Potential (GWP) – Total indicator is assessed for finding the environmental hotspots across the product life cycle stages. The highest contribution is from B6 operational energy use phase Manufacturing stage followed by A1 raw material supply stage. To assess the environmental impacts in raw materials, product stage A1-A3 is considered. It is observed that the printed circuit board assembly (PCBA) has the highest impacts followed by power supply unit.

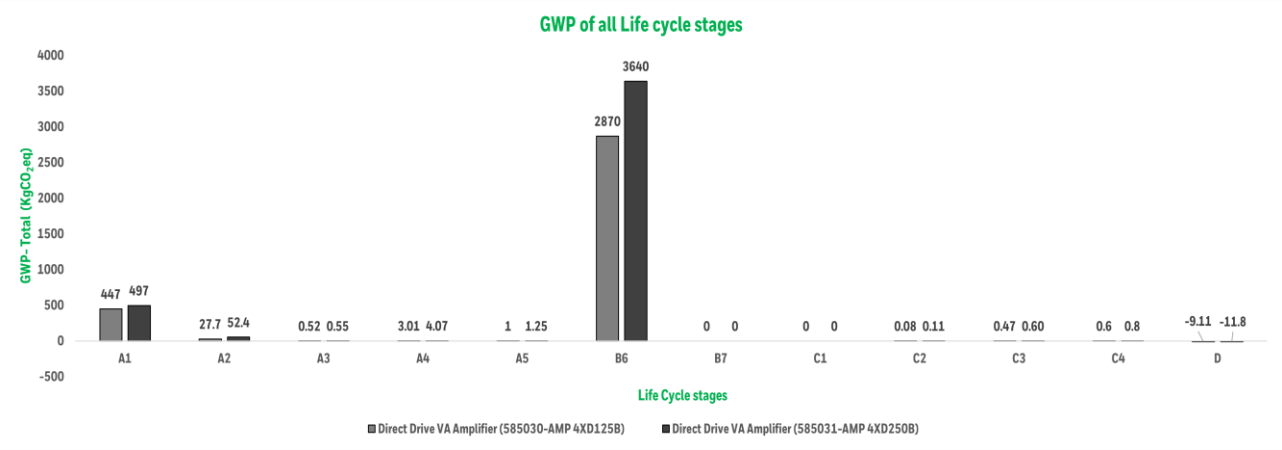


Figure 1 GWP- Total $KgCO_2eq$ of Direct Drive VA Amplifier (585030-AMP 4XD125B) & Direct Drive VA Amplifier (585031-AMP 4XD250B)

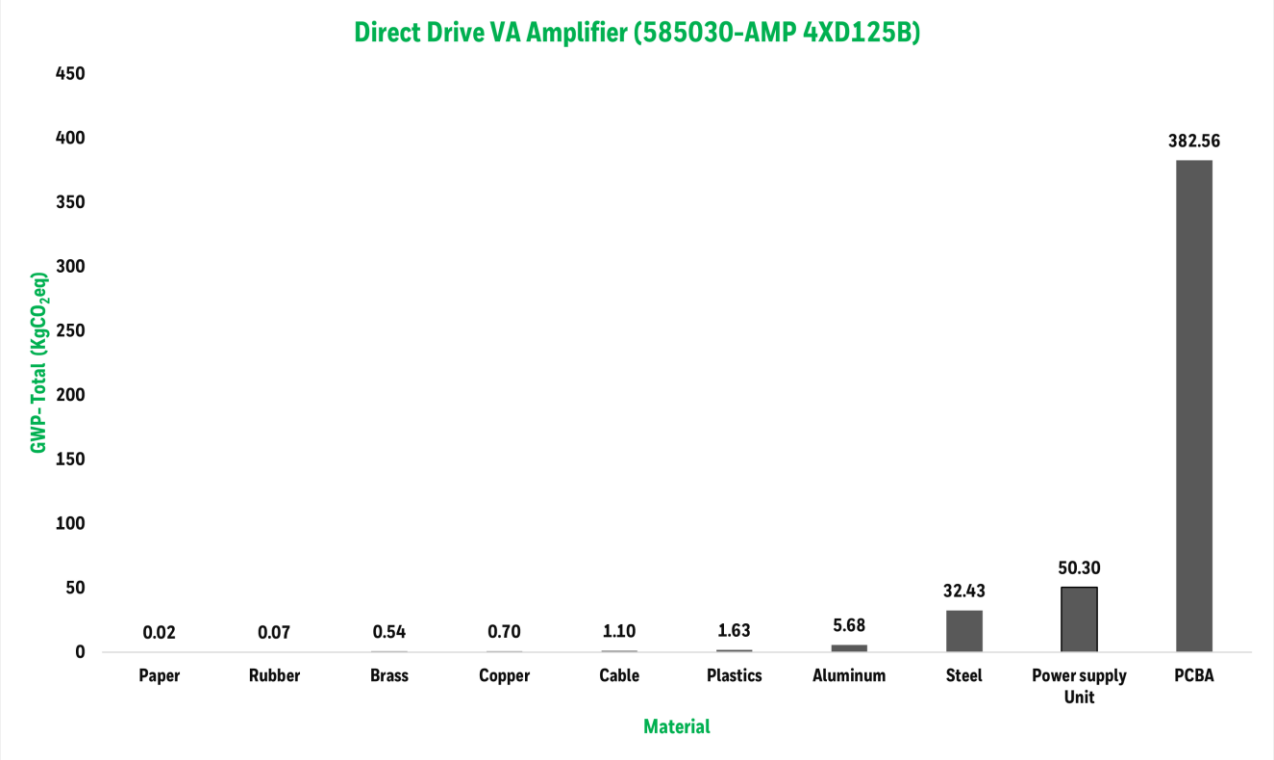


Figure 2 GWP – Total (A1) kg CO_2e of materials used in Direct Drive VA Amplifier (585030-AMP 4XD125B)

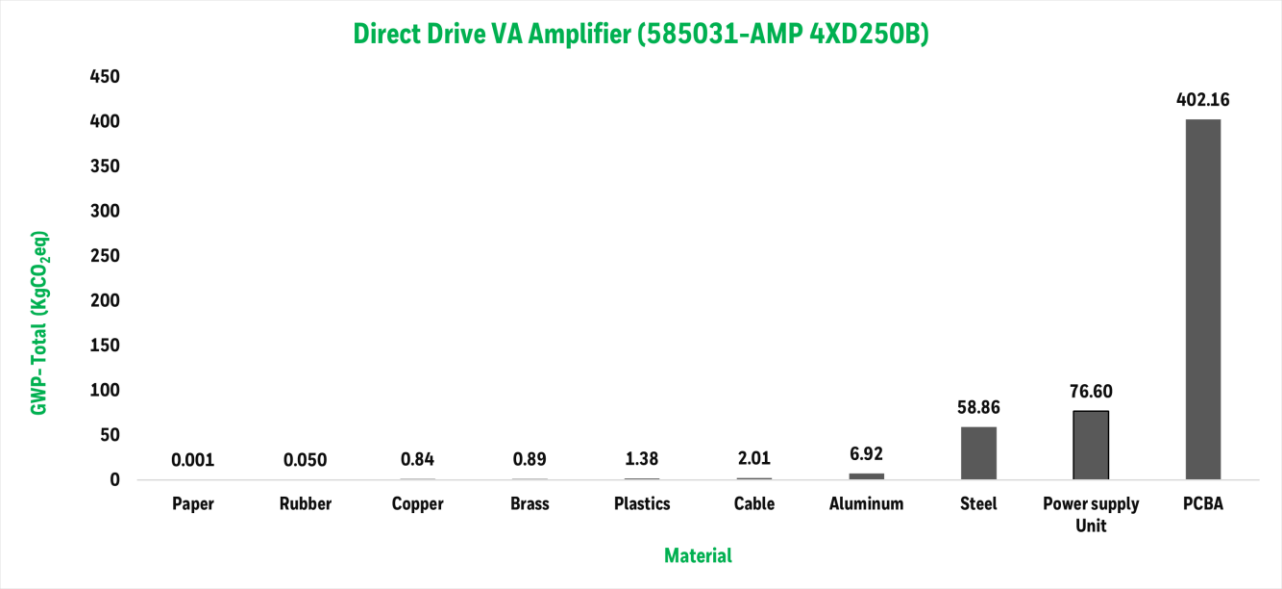


Figure 3 GWP – Total (A1) kg CO_2e of materials used in Direct Drive VA Amplifier (585031-AMP 4XD250B)

References

BSI. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. BS EN 15804:2012+A1:2013. London, BSI, 2013.

BSI. Environmental labels and declarations – Type III Environmental declarations – Principles and procedures. BS EN ISO 14025:2010 (identical to ISO 14025:2006). London, BSI, 2010.

BSI. Environmental management – Life cycle assessment – Principles and framework. BS EN ISO 14040:2006. London, BSI, 2006.

BSI. Environmental management – Life cycle assessment – requirements and guidelines. BS EN ISO 14044:2006. London, BSI, 2006.

BRE 2025 Product Category Rules (PN 514 Rev 3.2) for Type III environmental product declaration of construction products to EN 15804:2012+A2:2019

EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems 3. IEC/TR 62635 - Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment - Edition 1.0 2012-10

ISO 14040:2006 - Environmental management -Life cycle assessment - Principles and framework

ISO 14044:2006 - Environmental management - Life cycle assessment -Requirements and guidelines

ISO. (2006). ISO 14025: Environmental labels and declarations – Type III environmental declarations – Principles and procedures.

ISO. (2006a). ISO 14040: Environmental management – Life cycle assessment – Principles and framework. Geneva: International Organization for Standardization.

ISO. (2006b). ISO 14044: Environmental management – Life cycle assessment – Requirements and guidelines. Geneva: International Organization for Standardization.

PEP ecopassport® PROGRAM. (2023). Product Specific Rules for Fire Safety Systems (FSS), PSR-0019-ed1EN-2023 06 06.

EU Directive 2011/65/EU ROHS 3 REACH Waste Framework Directive 2008/98/EC (WFD)

BS EN 54-23:2010 - Fire alarm devices. Visual alarm devices

EN 54-16:2008 Fire detection and fire alarm systems — Part 16: Voice alarm control and indicating equipment

EN 54-4:1997/A2:2006 Fire detection and fire alarm systems — Part 4: Power supply equipment Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) (recast) Text with EEA relevance

Honeywell 2024 Inventory Data