epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with ISO 14025

[Disconnected Switch Unit DDV-16C]

EPD®

EPD® International ref. number
EPD-IES-0018253

This declaration is based on Product Category Rules: EN 50693:2019

Owner of the declaration:
LS ELECTRIC Co., Ltd.

Product name:
DSU-DDV16C

Declared unit:
A piece of DSU-DDV16C

Product category /PCR:
Core PCR EPDItaly 007
Sub PCR EPDItaly 012

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-7651-7033-EN

Registration Number:
NEPD-7651-7033-EN

Issue date: 27.09.2024

Valid to: 27.09.2029

LS ELECTRIC

The Norwegian
EPD Foundation

General information

Product:
DSU-DDV16C

Program holder:
The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Phone: +47 23 08 80 00
E-mail: post@epd-norge.no

Declaration Number:
NEPD-7651-7033-EN

This declaration is based on Product Category Rules:
EN 50693:2019 – Product Category Rules for Life Cycle Assessments of Electronic and Electrical Products and Systems
PCR EPDItaly007 – ELECTRONIC AND ELECTRICAL PRODUCTS AND SYSTEMS (REV.3.0, 2023/01/13
PCR EPDItaly012 – ELECTRONIC AND ELECTRICAL PRODUCTS AND SYSTEMS-SWITCHES (REV.0, 2020/03/16

Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Declared unit:
A piece of DSU-DDV16C

Declared unit with option:
A1-A5, B1-B7, C1-C4

Functional unit:
A piece of DSU-DDV16C (20.85kg
Including packaging materials during a service life of 20 years

Verification:
Independent verification of the declaration and data, according to ISO14025:2010

internal ☐ External ☐

Noh-hyun Lim

Noh-hyun Lim
Independent verifier approved by EPD Norway

Owner of the declaration:
LS ELECTRIC Co., Ltd.
Contact person: Gi-hyun Ryu
Phone: +82 10-3406-7955
e-mail: khyou@ls-electric.com

Manufacturer:
LS ELECTRIC Co., Ltd.
LS Tower, 127, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-Do, 14119, Republic of Korea
Phone: +82 43-261-6114
e-mail: khyou@ls-electric.com

Place of production:
95, Baekbong-ro, Heungdeok-gu, Cheongju-si, Chungcheongbuk-do, Republic of Korea

Management system:
ISO 14001:2015, ISO 9001:2015, ISO45001:2018

Organisation no:
116-81-19273

Issue date:
27.09.2024

Valid to:
27.09.2029

Year of study:
2023

Comparability:
EPDs from other programs than The Norwegian EPD Foundation may not be comparable.

The EPD has been worked out by:
Jiseon Jung, Bongkyu Oh from Ecoable Consulting Co., Ltd.

Approved

CEO of EPD Norway

Product

Product description:

The product 'DSU-DDV16C' is a DC Compact Switch-disconnectors which CPC is '46211-Elecrical apparatus for switching or protecting electrical circuits, or for making disconnections to or in electrical circuits, for a voltage exceeding 1000V.'

Product specification:

Material	Unit	Value	Contribution
Metals	kg	12.32	59.1 %
Plastics	kg	6.51	31.2 %
Paper	kg	1.60	7.7 %
Others	kg	0.22	1.0 %
PCB	kg	0.20	1.0 %

Technical data:

Technical data of the product is as follows.

CPC	46211 – "Elecrical apparatus for switching or protecting electrical circuits, or for making connections to or in electrical circuits, for a voltage exceeding 1000V"
IEC	IEC 60947-3; Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units.
Related standards	GB 14048.3 (CCC Certification)
Ampere frame	1600AF
Utilization category	DC-23A
Rated making capacity	50 kA peak (DC)
Rated short-time withstand current	50 kA/1s (DC)
Operation time	Max 40 ms (Openning time), Max 80 ms (Closing time)
Connection	Vertical type default

Market:

The target market of the product is Europe.

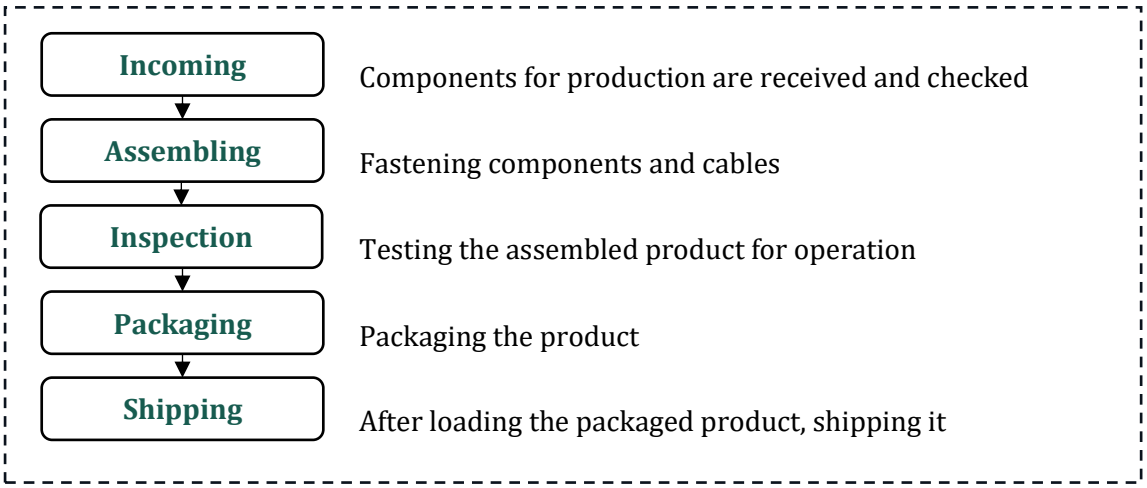
Reference service life:

Reference service life is assumed to 20 years. This figure was adapted from the scenario of use & maintenance stage on PCR EPDItaly012-Switch.

Product manufacturer:

LS ELECTRIC is leading the power system and automation sectors of the Korean industry, concentrating all effort and energy on 'product quality' and 'innovative ideas.'

Manufacturing process:



LCA: Calculation rules

Functional unit:

A piece of DSU-DDV16C(20.85kg) which possess the function of a switch-disconnector for 20 years with following specification including packaging.

Item	Unit	Value
Nominal voltage	V	1,500
Nominal current intensity	V	1,600
Number of poles	pieces	4
Nominal short-circuit breaking capacity	kV/s	50
Reference Lifetime	years	20
Unit weight	kg	20.85

Cut-off criteria:

This study includes the environmental impact of all processes without cut-off in “input” category. No known flows are deliberately excluded from this EPD.

In Output category, losses generated during the process are sold because of their value. This is worth selling, so the entire inventories in this system has to be allocated to loss. In this case, loss was cut-off as it was expected to be offset by the impact of treating losses

Allocation:

Background

Used system model used is ‘cut-off allocation.’ The ‘market for’ activity is used to consider the transport from secondary vendor to supplier.

Foreground

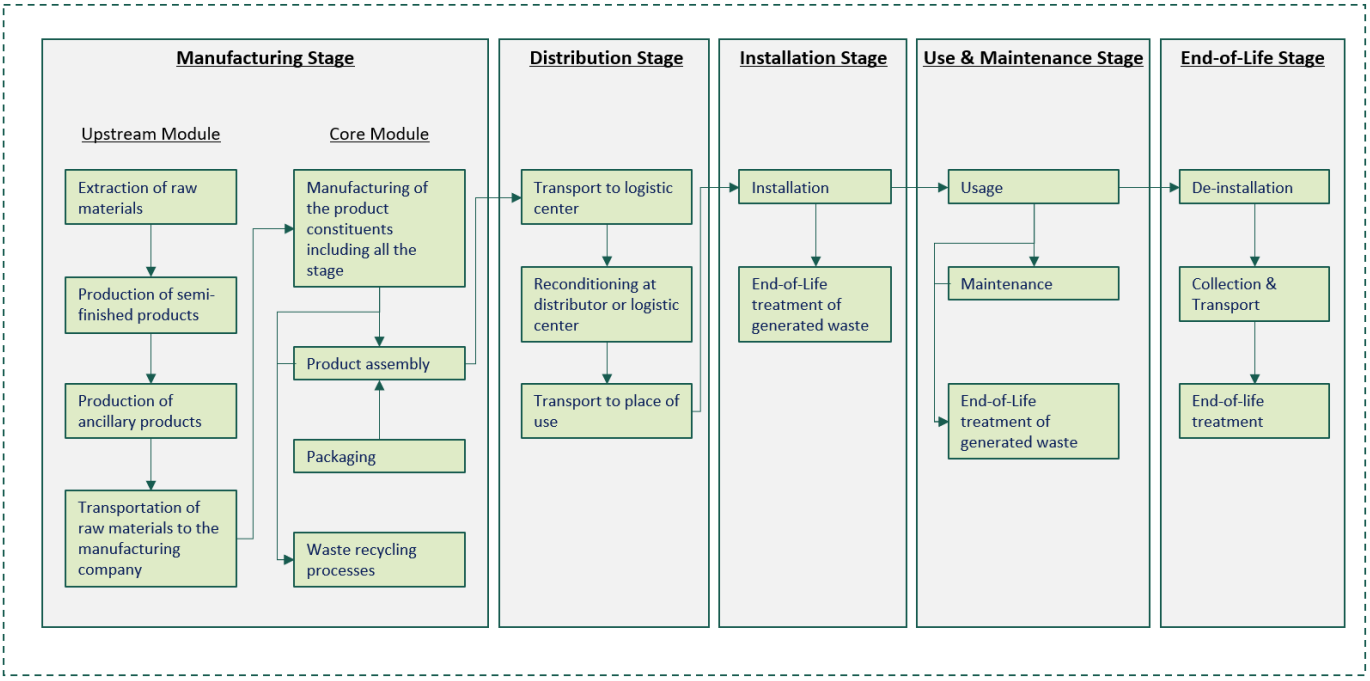
The core module is neither a multi-input/output process nor an open-loop recycling process. Therefore, there is no need for the allocation.

System boundary:

In accordance with EN 50693, PCR EPDItaly 007, and PCR EPDItaly 012, declared system is as follows

Manufacturing Stage		Distribution Stage(A4)	Installation Stage (A5)	Use & Maintenance Stage (B1-7)	End-of-Life Stage De-installation (C1-4)
Upstream Module (A1-2)	Core Module (A3)	Downstream Module			
X	X	X	X	X	X

System Boundary



Data quality:

Both primary and secondary data are used. The field data - Manufacturer specific data which provided by LS ELECTRIC manufacturing plant in Cheongju was mainly collected through the questionnaires and on-site visits. The method of data collection, the source, and DQI for all processes were described in the table below.

Materials	Source	Data quality	Year
Main Assy	BOM	Calculated	2022
Box	BOM	Calculated	2022
Cover Assy	BOM	Calculated	2022
Wire Assy	BOM	Calculated	2022
Sub Assy	BOM	Calculated	2022
Upper Pad	BOM	Calculated	2022
Lower Pad	BOM	Calculated	2022
Barrier	BOM	Calculated	2022
Screw (1)	BOM	Calculated	2022
Packing	BOM	Calculated	2022
Screw (2)	BOM	Calculated	2022
Name Plate	BOM	Calculated	2022
Energy_Electricity	BOM	Calculated	2022

All upstream processes are calculated by using LCI databases, Ecoinvent v3.8.
Since the voltage of electricity which used to produce the product is above 24kV for industry, dataset for modeling electricity during the manufacturing phase is high voltage, in Republic of Korea. For calculating the impact of electricity consumption, generic background data 'market for electricity, high voltage, electricity, high voltage, [kWh], KR, Ecoinvent v3.8'.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Upstream: Transport from production place to assembly/user

Since there is primary data for upstream transportation, no scenario is needed.
The type of transportation is assumed to be freight, lorry, 7.5-16 metric ton, EURO4.

Core Module

Primary data is used for the core module.

Category	Unit	Value
Raw materials	kg	19.34
Packaging materials	kg	1.51
Electricity	kWh	18.02

Downstream: Distribution

Transport to logistic center

The primary data on each location of 'transport to logistic center' is identified, whereas a mean of transport is not.
Distance from the plant to Busan Port; a stopover is 275.4 km, the shortest distance according to the 'Kakao map.' The arrival port of the product from Busan Port is Valencia Port, and the logistic center is also specified. Each distance is measured with 'Netpas Distance' and 'Google Map' in the shortest option.
The overland distribution scenario of EURO 4 category vehicle was applied to model transport from the arrival port to the logistic center. The scenario was defined in '4.2.3.3 Distribution Stage' of PCR EPDItaly 012

Transport to place of use

Primary data for 'transport to place of use' does not exist. Therefore, the overland distribution scenario of 300 km and EURO 4 category vehicle was applicated. The scenario was defined in '4.2.3.3 Distribution Stage' of PCR EPDItaly 012

Downstream: Installation

End-of-life of packaging

Primary data for the disposal and recycling of packaging is unavailable. Therefore, the end-of-life of packaging is assumed to follow the waste treatment ratio by material provided by Eurostat.

Category	Landfill	Incineration	Energy Recovery	Recycling
Metal (Ferro + Non-Ferro)	0.0%	0.0%	0.0%	100.0%
Plastics	5.2%	0.4%	23.2%	71.3%
PCB Containings	0.0%	50.0%	0.0%	50.0%
Paper	0.2%	0.0%	1.5%	98.3%

Downstream: Use & Maintenance

The energy consumption analysis during the use stage is following 'PCR EPDItaly012-Switch'. The coefficient used in the formula represent the value of product specifications tested following the test method specified in the relevant industry standards. The total energy consumption of the representative product over its reference service life time(RSL) was calculated as below

$$E_{use}[kWh] = \frac{P_{use} \times 8760 \times RSL \times \alpha}{1000}$$

Item	Unit	Value
P_{use}	W	312
RSL	year	20
α	%	30%
E_{use}	kWh	16,399

Average production mix from Europe, medium voltage of applied electricity for the use stage.

Electricity mix	Source	Amount (kg CO2 eq./kWh)	GWP (kg CO2 eq.)
market group for electricity, medium voltage, electricity, medium voltage, [kWh], RER	Ecoinvent v3.8	3.90E-01	6.40E+03

Downstream: Transport to waste processing

As no primary data available, the impacts on 'collection & transport' during end-of-life stage was calculated by using the transport scenario in EN 50693.

Type	Payload(%)	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck	85	Truck(EURO4)	1,000	-	-

Downstream: End-of-Life

In accordance with 'PCR EPDItaly 012 - Switch', the impacts of End-of-Life stage were applicated following assumptions. The waste treatment ratio by types of materials is assumed to be same as EU waste statistical data from Eurostat and is calculated in accordance with IEC/TR 62635

Category	Electrical and electronic tools
Landfill	5.5%
Energy Recovery	86.4%
Recycling	8.1%
Recycling and preparing for reuse	78.3%

LCA: Results

Calculations for all parameters are done by utilizing LCA software SimaPro 9.3.0.3.
All LCA results below are according to declared unit.

Environmental impact descriptive parameters

Parameter	Unit	Total	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	Use&Maintenance (B1-B7)	End-of-Life (C1-C4)
GWP-total	kg CO_2 eq.	6.57E+03	1.34E+02	1.09E+00	1.28E-01	6.40E+03	4.43E+01
GWP-fossil	kg CO_2 eq.	6.34E+03	1.34E+02	1.09E+00	1.01E-01	6.16E+03	4.42E+01
GWP-biogenic	kg CO_2 eq.	2.14E+02	-3.19E-02	2.98E-04	2.70E-02	2.14E+02	9.04E-02
GWP-luluc	kg CO_2 eq.	1.47E+01	1.41E-01	2.01E-05	1.96E-05	1.45E+01	7.69E-03
ODP	kg CFC-11 eq.	3.13E-04	7.89E-06	2.46E-07	1.32E-08	2.99E-04	5.72E-06
AP	mol H^+ eq.	3.60E+01	3.41E+00	4.89E-03	3.30E-04	3.25E+01	7.37E-02
EP-freshwater	kg P eq.	6.52E+00	2.82E-01	2.06E-05	1.73E-05	6.23E+00	1.10E-02
EP-marine	kg N eq.	5.89E+00	2.67E-01	1.77E-03	1.37E-04	5.60E+00	2.00E-02
EP-terrestrial	mol N eq.	5.09E+01	2.89E+00	1.94E-02	1.23E-03	4.78E+01	1.96E-01
POCP	kg NMVOC eq.	1.39E+01	8.36E-01	5.05E-03	4.30E-04	1.30E+01	5.21E-02
ADP-minerals & Metals	kg Sb eq.	8.23E-02	8.20E-02	9.02E-08	6.20E-09	3.40E-04	3.56E-06
ADP-fossil	MJ, net calorific value	1.35E+05	1.77E+03	1.54E+01	8.00E-01	1.33E+05	2.43E+02
WDP	m3 eq.	1.55E+03	1.10E+02	5.96E-03	7.84E-03	1.44E+03	5.06E+00

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; EP-freshwater: Eutrophication potential-freshwater compartment; POCP: Formation potential of tropospheric ozone; ADP minerals & metals: Abiotic Depletion for non-fossil resources potential; ADP-fossil: Abiotic Depletion for non-fossil resources potential, WDP: Water deprivation potential.

Reading example: 9.0 E-03 = $9.0*10^{-3}$ = 0.009

Resource consumption descriptive parameters

Parameter	Unit	Total	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	Use&Maintenance (B1-B7)	End-of-Life (C1-C4)
PENRE	MJ, net calorific value	5.31E-01	1.30E-01	4.60E-05	1.82E-05	3.92E-01	9.27E-03
PERE	MJ, net calorific value	3.37E+03	4.09E+01	5.35E-03	3.58E-03	3.33E+03	1.00E+00
PENRM	MJ, net calorific value	1.35E+05	1.77E+03	1.54E+01	8.00E-01	1.33E+05	2.43E+02
PERM	MJ, net calorific value	2.06E+04	1.51E+02	1.47E-02	1.94E-02	2.04E+04	5.60E+00
PENRT	MJ, net calorific value	1.35E+05	1.77E+03	1.54E+01	8.00E-01	1.33E+05	2.43E+02
PERT	MJ, net calorific value	2.39E+04	1.92E+02	2.00E-02	2.30E-02	2.37E+04	6.61E+00
FW	m3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MS	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PENRE: Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material; PERE: Use of renewable primary energy excluding renewable primary energy resources used as raw material; PENRM: Use of nonrenewable primary energy resources used as raw material; PERM: Use of renewable primary energy resources used as raw material; PENRT: Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials); PERT: Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); FW: Net use of fresh water; MS: Use of secondary materials; RFS: Use of renewable secondary fuels, NRSF: Use of non-renewable secondary fuels.

Waste production descriptive parameters

Parameter	Unit	Total	Manufacturing (A1-A3)	Distribution (A4)	Installation (A5)	Use&Maintenance (B1-B7)	End-of-Life (C1-C4)
HWD	kg	4.22E-02	3.04E-03	4.16E-05	2.18E-06	3.83E-02	8.29E-04
NHWD	kg	2.16E+02	1.97E+01	4.06E-03	1.79E-02	1.88E+02	7.89E+00
RWD	kg	9.96E-01	3.54E-03	1.08E-04	5.29E-06	9.91E-01	1.53E-03
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	kg	0.00E+00	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	0.00E+00	0.00E+00

HWD: hazardous waste disposed; NHWD: non-hazardous waste disposed; RWD: radioactive waste disposed; MER: materials for energy recovery; MFR: material for recycling; CRU: components for reuse; ETE: exported thermal energy; EEE: exported electricity energy

Additional requirements

Greenhouse gas emission from the use of electricity

The manufacturing stage

National production mix from Korea, high voltage of applied electricity for the manufacturing stage

Electricity mix	Source	Amount (kg CO2 eq./kWh)	GWP (kg CO2 eq.)
market for electricity, high voltage, electricity, high voltage, [kWh], KR	Ecoinvent v3.8	6.93E-01	6.40E+00

The use stage

Average production mix from Europe, medium voltage of applied electricity for the use stage.

Electricity mix	Source	Amount (kg CO2 eq./kWh)	GWP (kg CO2 eq.)
market group for electricity, medium voltage, electricity, medium voltage, [kWh], RER	Ecoinvent v3.8	3.90E-01	6.40E+03

Dangerous substances

The product contains no substances given by the REACH Candidate list

Indoor environment

The product meets the requirements for low emissions.

Carbon footprint

Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2010 (2010) Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO 14040:2006 (2006) Environmental Management-Life Cycle Assessment-Principles and framework

ISO 14044:2006 (2006) Environmental Management-Life Cycle Assessment-Requirements and Guidelines

EN 15804:2021 (2021) Sustainability of construction works-Environmental product declarations – Core rules for the product category of construction products

EN 50693:2019 (2019) Product category rules for life cycle assessments of electronic and electrical products and systems

PCR EPDItaly007 (2023) Electronic and electrical products and systems, rev. 3.0

PCR EPDItaly012 (2020) Electronic and electrical products and systems – switches, rev.0

Ecoinvent v3.8 (2021)

epd-norge The Norwegian EPD Foundation	**Program Operator**	tlf	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	e-post:	post@epd-norge.no
	Norway	web	www.epd-norge.no
epd-norge The Norwegian EPD Foundation	**Publisher**	tlf	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	e-post:	post@epd-norge.no
	Norway	web	www.epd-norge.no
LS ELECTRIC	**Owner of the declaration**	tlf	+82 10 3406 7955
	LS ELECTRIC Co., Ltd.	Fax	+82 2 2034 4625
	LS Tower, 127, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-Do, 14119	e-post:	khyou@ls-electric.com
	Republic of Korea	web	www.ls-electric.com
ecoable	**Author of the life cycle assesment**	tlf	+82 2-6959-8885
	Ecoable Consulting Co., Ltd.	Fax	+82 70-4327-7279
	201, 68-23 Guui-dong, Gwangjin-gu, Seoul-si,	e-post:	khcha@ecoable.co.kr
	Republic of Korea	web	www.ecoable.co.kr

EPD for the best environmental decision

The Norwegian EPD foundation
www.epd-norge.no

epd-norway
Global Program Operator