Environmental Product Declaration

EPD I – ANPA - 7

HD4/C

ABB T&D SpA - SACE T.M.S.

Presentation

Aim of this document is to supply information on the environmental performances of the HD4/C product life cycle, conforming to the "General rules for the drafting of Environmental Product Declaration" (ANPA, July 2001 draft) and to the category "Product Specific Requirements".
The environmental performance is measured by means of an LCA study carried out in accordance to ISO 14040 standards.

Manufacturer information

ABB T&D SpA - SACE T.M.S
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Dalmine production site is certified ISO 14001 since 1997.

Product description

The HD4 sulphur hexafluoride medium-voltage circuit breaker is used in electric distribution to control and protect lines, distribution and transformation substations, motors, transformers, condenser batteries etc.
It conforms to CEI 17-1 standards with the following characteristics:

- Extremely compact dimensions
- Fixed and pull-out versions
- Mechanical safety blocks against wrong manoeuvres
- Arc extinction with no current snatching
- No arch re-establishment after interruption thanks to arch quenching properties of the dielectric means.
- Poles sealed for life
- Energy-store command with standard anti-pumping device
- Maintenance free
- On demand, control device for SF6 gas

Scope of declaration

The LCA study is carried out on a pull-out version of the HD4 series, called HD4/C. The circuit breaker rated characteristics are the following:

· rated current 630 A
· rated voltage 24kV
· rated breaking capacity up to 25kA

Functional unit

The functional unit, as specified in the Product Specific Requirements PSR-I 05:2001, is represented by the rated current. The reference flow for the LCA study is represented by the single circuit breaker.

System boundaries

The boundaries of the system surveyed by the LCA study conform to PSR-I 05:2001. For what unspecified by the Product Specific Requirements the following holds true:

Production

The system includes the production phases of all material concurring to make the circuit breaker, respecting the amounts shown in the chart.

Materials	**[g]**	**%**
Steel	68.105	47.6
Stainless steel	14.030	9.8
Aluminum	899	0.6
Alumina	378	0.3
Copper	23.151	16.2
Copper-tungsten20	315	0.2
Polyamide 11	15	0.0
Polyamide 66	161	0.1
Polycarbonate	140	0.1
Polycarbonate+FB30	1.069	0.7
Polyester glass	2.337	1.6
PVC	8	0.0
Bronze	9	0.0
PTFE	227	0.2
Epoxy resin	23.751	16.6
Epoxy resin-Fe10	844	0.6
SF6	282	0.2
Brass	198	0.1
Partial	**135.919**	**95.0**
Weight	143.000	100.0
Cut off		**5**

Manufacture of finished product is carried out at the ABB T&D – Sace TMS Division factory located in Dalmine (Bergamo).

The environmental performance declaration is based on specific data, except for PTFE production for which generic data were used.

The reference energy mix is the Italian one (ANPA I – LCA version 2 databank).

Packaging of components and of finished product are not included in the system.

Sulphur exafluoride losses at the Dalmine site were included and considered equal to 3% of the gas mass contained in HD4/C.

Transportation

The system includes the transportation phases of finished and semifinished products concurring to make up the finished product. The transportation of finished product to clients was not considered since the product is sold on the international market.

Usage

The product usage phase brings along potential impacts, energy consumption and waste due to the production and supply of dissipated energy due to the Joule effect.

The reference energy mix used in the usage phase is the European one (ANPA I – LCA version 2 databank).

Usage conditions defined by reference PSR are summarized below:

Ie [A]	315
Time [h]	175.200

The resistance phase being equal to

R_{phase} [Ω]	$110.5*10^{-6}$

The power and therefore the energy losses are:

P [W]	32.7
Energy $_{20\ years}$ [MJ]	20.652

The yearly losses of sulphur exafluoride, during usage, were included in amounts equal to 0.29% (maximum admitted loss).

End of life

The environmental performance declaration regarding the phase of the product's end of life is made under the hypothesis that the best available technology is used and is based on the following scenario.

Material	Recycle [g]	Recovery [g]	Landfill [g]	Emission [g]
Steel	61.295		6.811	
Stainless steel	12.627		1.403	
Aluminum	809		90	
Alumina	340		38	
Copper	18.521		4.630	
Copper-	252		63	
Polyamide 11			15	
Polyamide 66			161	
Policarbonate			140	
Polycarbonate			1.069	
Polyester glass			2.337	
PVC			8	
Bronze	7		2	
PTFE			227	
Epoxy resin		23.751		
Epoxy resin-			844	
SF6		266		13

* by recovery we mean the incineration process with energy recovery

** by emissions we mean emissions into the atmosphere attributable to the gas end of life, before the final recovery and/or disposal.

Environmental performance declaration

Consumption of resources

Consumption of main resources associated to the various phases of the life cycle is the following:

Resource	Production [kg]	Use [kg]	End of life [kg]
Water	17.100	131.000	-1.600
Bauxite	4.3	0.36	-3.9
Limestone	37.9	17.1	-0.2
Coal	88.3	723	-21
Iron	83.2	7.6	-74
Natural gas	75.0	93.1	0.1
Gravel	0.96	38.1	-0.4
Lignite	4.15	925	-11
Oil	47.5	167	-64
Copper	26.1	0.06	-15
Rock salt	44.0	0.54	-0.1
Uranium	0.00077	0.062	-0.0006

Consumption of gross energy

The consumption of gross energy tied to the various phases of the life cycle and distinguished between the non-renewable and the renewable energy is the following:

Non renewable	Production [kg]	Use [kg]	End of life [kg]
Coal	1.790	13.730	-370
Gas	3.890	4.830	4
Lignite	41	9.250	-107
Oil	2.090	7.530	-2.740
Uranium	348	27.880	-281
Total	**8.159**	**63.220**	**-3.494**
Renewable			
Hydro energy	132	4.070	-96
Wood	127	109	-1
Total	**259**	**4.179**	**-97**
Total gross energy	**8.418**	**67.399**	**-3.591**

Potential Environmental Impacts

Potential environmental impacts tied to the various phases of the life cycle are the following:

Impact category	Production	Use	End of life
Acidification (kgSO2eq)	4.27	21.4	-1.6
Climate changes (kgCO2eq)	728	3.410	129
Eutrophication (kgPO4eq)	0.33	0.72	-0.10
Depletion of stratospheric ozone layer (kgCFC11eq)	0.00020	0	0
Photochemical ozone creation (kgC2H4eq)	0.51	1.57	-0.11

Waste

Waste produced in the various phases of the life cycle are the following

Waste	Production [kg]	Use [kg]	End of life [kg]
Industrial	169	392	-13
Hazardous	1.02	0.041	-0.001

Additional information

Traceability of potential impacts

Potential environmental impacts regarding the supply of electric power are those associated to the usage of the analysis data of the inventory contained in the I-LCA database, version 2 (ANPA-October 2000).

1 MJ produced with energy mix	Italian	European
Acidification (kgSO2eq)	0,00151	0,00104
Climate changes (kgCO2eq)	0,197	0,147
Eutrophication (kgPO4eq)	0,0000582	0,0000350
Depletion of stratospheric ozone layer (kgCFC11eq)	0	0
Photochemical ozone creation (kgC2H4eq)	0,000170	0,0000763

Treatment procedures for exafluoride gas

All processes involving the treatment of SF6 follow the procedures set by the "Technical brochure no.117" of the CIGRE Guide in order to avoid the leakage of gas in the atmosphere.
ABB organized a world-wide service centers network which can offer:

- gas recovery service
- supply or leasing of equipment for gas treatment
- training courses for personnel in charge of recycling the gas

Reference documents

- ANPA (July 2201 draft) "General rules for the drafting of Environmental Product Declarations"
- LCA study of the HD4 circuit breaker (ref. EPD I – 3 rev. 0)
- Product Specific Requirements (PSR - I 05:2001)
- ISO 14020 (2000) "Environmental labels and declarations – Principles and guidelines"
- ISO/TR 14025 (2000) "Environmental labels and declarations – Type III environmental declarations"
- CIGRE Guide (1997) "Technical brochure no. 117"

Validation

The truthfulness of the information contained in this document is guaranteed by the EPD I – ANPA - 7 validation provided by ANPA.