Environmental Product Declaration

Registration number: S-P-00047

Rev. 0 – 11/06/03

Tmax T1

Low voltage circuit breaker

ABB SACE SpA

Information about the company and the product

This document aims to provide information on the environmental performance of the Tmax T1 product life cycle, in conformity with the standard "MSR 1999:2 Guidelines for the Environmental Product Declaration (EPD)"; and with product specific requirements dictated by the PSR for low voltage circuit breakers.
The environmental performance is determined by means of an LCA study carried out in accordance with the ISO 14040 Standards.

Company

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ABB SACE, is a company of the ABB Group working in the area of low voltage products and technologies of the Automation Technology Products Division. The company offers a complete and integrated range of products for industrial and residential sectors within the context of a constant technological development process.

The circuit breaker is produced in Frosinone plant. This site has been ISO 14001 certified since 1997. From 2000 the Integrated Management System (Quality, Environment and Safety) has also been implemented and certified. The processing activities carried out at the facility are assembly and testing.

Product description

Tmax is the new series of ABB SACE low voltage moulded-case circuit breakers. These are solutions suitable for installation in both industrial and civil spheres.
The Tmax T1 circuit breaker – the smallest of the series – stands out in the current panorama for its high performance/dimensions ratio. In fact, it has extremely compact dimensions (WxHxD = 76x130x70) and notably high performances: rated current of 160 A, and breaking capacity Icu equal to 36 kA at 415 V AC.
The environmental performances obtained thanks to application of the DfE (Design for Environment) methodology during the project design development stage are worthy of note.

Special attention was paid to limiting the energy dissipated by Tmax T1 during its use.
Further improvements introduced in the product with application of the DfE were:

- use of recyclable thermoplastic resins to partly replace the thermosetting resins;
- marking of the plastic components aimed at helping their identification and end of life recycling/recovery;
- use of design solutions aimed at simplifying dismantling of the circuit breaker at the end of its life, which, by allowing separation of the individual components, encourages its recycling and/or its correct waste disposal management;

The Tmax T1 has the following electrical characteristics:

- rated uninterrupted current : Iu = 160 A
- 3/4 poles (there is also a single-pole version)
- rated service voltage: Ue = 690 Vac; Ue = 500 Vdc
- impulse withstand voltage; Uimp = 8kV
- rated insulation voltage: Ui = 800V
- short-circuit breaking capacity (version N) according to the service conditions as indicated below.

Rated voltage (V)	Breaking capacity (kA)
220/230	50
380/415	36
440	22
500	15
690	6

Scope of the declaration

The LCA study was carried out on the three-pole type of Tmax circuit breaker in accordance with the ISO 14040 Standards.

Functional unit

The functional unit, as specified under the Product Specific Requirements, is represented by a circuit breaker in service for a 15 years estimated lifetime, with annual use of 4380 hours and a rated current of 160 A, intended as the one defined in the IEC 947-2 Standards.

System boundaries

Production

The system includes the production stages of the materials and components constituting the circuit breaker, observing the quantities indicated in the table.

Material	**[g]**	
ABS	5.7	0.6%
Copper	134	14.0%
Polyester with 20% glass fibre	193	20.1%
Polyester with 25% glass fibre	253	26.4%
Polyamide with 25% glass fibre	9	0.9%
Polyamide with 30% glass fibre	6.7	0.7%
Polyamide	2	0.2%
Polycarbonate with glass fibre 20%	8.1	0.8%
Polycarbonate	33.5	3.5%
Rolled steel	238	24.8%
Steel	68	7.1%
Silver	2.8	0.3%
Total	**953.8**	**99.3%**
Circuit-breaker weighed	**960.5**	**100%**
Cut-off	**6.7**	**0.7%**

Finished product assembly and testing are carried out in the ABB SACE facility in Frosinone.
The reference energy mix used during the production stage is the Italian one (ANPA I-LCA version 2 data base).
Packing of the finished product and components is not included in the system.

Transport

The system includes the transport stages regarding raw materials and semi-finished products as far as the production site. Transport of the finished product onto the market was not taken into consideration since this has extremely variable characteristics, which depend on the end customer.

Usage

The service stage of the product leads to potential impacts, consumption of resources and production of waste caused by production and supply of dissipated energy due to the Joule effect.
The reference energy mix used during the service stage is the European one (ANPA I-LCA version 2 data base).
Under the service conditions, defined by the Reference PSR, the energy dissipated by the main circuit resistance is 2,221 MJ (phase resistance measured equivalent to 0.49*10-3Ω).

Declaration of the environmental performance

Consumption of natural resources

Consumption of the main resources associated with the different life cycle stages is as follows

Resources	Production [kg]	Use [kg]
Renewable resources		
Without energy content		
Water	197	15,800
With energy content		
Wood	0.038	0.657
Non-renewable resources		
Without energy content		
Baryte	0.003	0.109
Copper	0.149	0.007
Iron	0.318	0.915
Sand	0.158	0.498
Silver	0.0029	0
With energy content		
Coal	0.785	86.6
Lignite	0.098	111
Natural gas	0.618	11.2
Oil	1.127	20.0
Uranium	0.000024	0.007552

Consumption of primary energy

The consumption of primary energy associated with the different stages of the life cycle, divided between non-renewable and renewable energy is as follows

Non-renewable resources	Production [MJ]	Use [MJ]
Coal	14.9	1,650
Gas	32.1	580
Lignite	0.98	1,110
Oil	50.7	900
Uranium	11.1	3,400
Total	**109.78**	**7,640**
Renewable resources		
Hydraulic energy	5.21	491
Wood	0.77	13.1
Total	**5.98**	**504.1**
Total primary energy	**115.8**	**8,144.1**

Consumption of electric energy

Electric energy	Production [MJ]	Use [MJ]
Consumption and dissipation	34.83	2,221

Potential environmental impacts

The potential environmental impacts associated with the different life cycle stages are the following

Categories of impact	Production	Use
Acidification [mol H^+eq]	1.98	80.3
Global warming [kg CO_2eq]	7.68	364
Eutrophication [kgO_2eq]	0.165	4.049
Stratospheric ozone depletion [kg CFC_{11}eq]	0	0
Photochemical ozone creation [kg C_2H_4eq]	0.0045	0.072

Waste

The waste produced in the different life cycle stages is as follows

Waste	Production [kg]	Use [kg]
Non-hazardous waste	0.978	48.87
Hazardous waste	0.012	0.069

Additional information

Marking plastic parts

Where technologically possible, the plastic parts of the circuit-breaker are marked in accordance with the ISO 11469 and ISO 10431/2/3/4 Standards to facilitate their identification and recovery at the end of their life.
See the example illustrated in the figure relative to Polyamide in 30% glass fibre.

> PA 66 – GF 30 <

Recycling

Based on the analysis of the materials which make up the product and coherently with the best technologies available to date, the potential recycling rate of the T1 is higher than 47%.

Material**	**Recycling [g]**	**Recovery* [g]**	**Disposal [g]**
ABS	5.7		
Steel	68		
Rolled steel	238		
Silver	2.8		
Copper alloys			27.0
Polyamide		2	
Polyamide with 25% glass fibre		9	
Polyamide with 30% glass fibre		6.7	
Polycarbonate	33.5		
Polycarbonate with 20% glass fibre		8.1	
Polyester with 20% glass fibre		193	
Polyester with 25% glass fibre		253	
Copper	107		
Total	**455.0**	**471.8**	**27.0**
Total	**47.7%**	**49.5%**	**2.8%**

* by the term recovery, the incineration process with energy recovery is intended.
** the end of life scenario does not take the materials constituting the cut-off into consideration.

Reference documentation

- MSR 1999:2: Guidelines for the Environmental Product Declaration (EPD);"
- LCA study of TMAX T1 (EPD I – 1 rev. 4)
- PSR 02:2003 “Low voltage circuit-breakers”
- ISO 14020 (2000) "Environmental labels and declarations - Principles and guidelines"
- ISO/TR 14025 (2000) "Environmental labels and declarations - Type III environmental declarations"
- ISO 11469 “Plastics – Generic identification and marking of plastics products”
- ISO 1043-1 “Plastics – Symbols and abbreviated terms - Part 1: Basic polymers and their special characteristics”
- ISO 1043-2 “Plastics – Symbols - Part 2: Fillers and reinforcing materials”
- ISO 1043-3 “Plastics – Symbols and abbreviated terms - Part 3: Plasticizers”
- ISO 1043-4 “Plastics – Symbols and abbreviated terms - Part 4: Flame retardants”

Validation

This EPD and the relative Life Cycle Assessment study have been approved by RINA S.p.A. Certification Body (www.rina.it) for the certification, in accordance with MSR 1999:2 standard provided by Swedish Environmental Management Council.

Further information regarding the aims of the Environmental Product Declaration, the validation course, the standard references and documents mentioned above, as well as the list of the EPDs validated in the various countries, are available on the following site: www.environdec.com.

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