Surge Arresters, Type POLIM-H

Environmental Product Declaration

Organisational Framework

Manufacturer

ABB Switzerland Ltd
High Voltage Products
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ABB Switzerland Ltd, High Voltage Products, is part of the ABB Power Products Division.

Environmental Management

ABB Switzerland Ltd, High Voltage Products, has been ISO 14001-certified since 1998. Life Cycle Assessment (LCA) is applied continually to all product develpments.

Product Description

ABB surge arresters are principally characterised as the latest design of metal-oxide surge arresters without spark gaps. These feature an unbreakable design with a silicone housing. They guarantee reliable and economical protection of railway networks and locomotives against overvoltages caused by lighting strikes and circuit breaker operations.

Years of experience in the railway market confirm the suitability of type POLIM-H surge arresters for applications with the most exacting requirements up to 44 kV.

Procedure

This environmental product declaration is based on the LCA study “Life Cycle Assessment POLIM-H”. The “ECOLAB” ABB standard software package (version 5.3.2a) developed by Nordic Port S.A. was used for the LCA study. The requirements in the “Technical Report for Surge Arresters” were also taken into account. The POLIM-H 4.2 DC was analysed as representing the railway surge arrester assortment.

The life cycle of the product was divided into 3 phases: Manufacture, use and disposal/recycling. Transports of supplied components and transports of products to customers were assigned to the manufacture phase. As far as disposal is concerned, it was assumed that the product components would not be reused.

The result is composed of material and energy inventories, as well as a classification of environmental impacts occurring during the three life cycle phases and transportation.

Input Data for the Life Cycle Assessment

Functional Unit

The functional unit of the life cycle assessment is a type POLIM-H 4.2 DC surge arrester with a total weight of 8,371 kg.

Manufacture Phase

The materials used for the product are listed in the following table.

Material	Amount (kg)
Aluminium	4.60
Steel	0.03
Zinc oxide	0.71
Epoxy resin	0.28
Organic materials	0.00
Silicone	1.25
Card	1.5

Table 1: Inventory of materials used

Transports of material from the suppliers to our production site were taken into account for each surge arrester as follows: 2.14 kg raw material from the USA (10,000 km) by ship and 3.04 kg semi-finished products from the EU area (600 km) by truck.

Current consumption and thermal energy in final production were not included.

An average transport mix for a surge arrester was calculated from the information about distribution of deliveries to different continents as well as the distribution between the selected means of transport: air, sea, road and rail. This is composed of 2,559 km air freight, 1882 km sea transport, 730 km road transport and 23 km rail transport.

Use Phase

Electrical power losses during the use phase were taken into account.

Energy	Manufacture	Use	Disposal
Electricity	0	5.01	0

Table 2: Electrical power losses (kWh)

A power loss of 0.167 kWh/year over a service life of 30 years was used as the basis. The OECD mix of electrical power was used for calculating the environmental impact resulting from generating the power attributable to the electrical power losses.

Disposal and Recycling

It was assumed that all the surge arresters will be disposed of in landfill sites. Transportation to the disposal site was not taken into account.

Environmental Performance

Significant environmental impacts occur during the manufacture phase due to the air freight and the production of aluminium and silicone. Other metals and transportation are responsible for smaller contributions.

The environmental impacts in the use phase are chiefly due to generating the power attributable to the electrical power losses.

The disposal phase is insignificant in terms of the overall balance.

Resources	Manufacture	Use	Disposal
Coal	13.00	1.44	0.00
Oil	7.20	11.63	0.01
Gas	1.82	0.39	0.00
Uranium	0.00	0.00	0.00
Aluminium	4.70	0.00	0.00
Zinc	0.02	0.00	0.00

Table 3: Use of non-renewable resources (kg)

Resource	Manufacture	Use	Disposal
Hydroelectric power	7.08	0	0

Table 4: Use of renewable resources (kWh)

Impact	Manufacture	Use	Disposal
Global Warming Potential (GWP) in kg CO_2 equivalents	69.30 (57%)	43.40 (35%)	9.30 (8%)
Acidification Potential (AP) in kmol H^+ equivalents	12.50 (67%)	6.25 (33%)	0.00 (0%)
Ozone Depletion Potential (ODP) in kg CFC_{11} equivalents	0.00	0.00	0.00
Photochemical Ozone Creation Potential (POCP) in kg C_2H_4 equivalents	0.00	0.00	0.00
Nutrification Potential (NP) in kg O_2 equivalents	0.00	0.00	0.00

Table 5: Environmental impacts in the life cycle phases

Remarks on GWP

The major contributions to GWP during the manufacture phase (57%) are attributable to aluminium production and delivery of the product by air freight. Lesser contributions are due to silicone production and the manufacture of diesel fuels. The dominant factor during the use phase (35%) is electrical power losses during operation and, during the disposal phase (8%), the organic components that decay to carbon dioxide and methane.

Remarks on AP

The acidification potential in the atmosphere (acid rain) is predominantly due to the use of fossil fuels.

The manufacture phase accounts for about two thirds and the use phase about one third in terms of proportions.

Remarks on ODP, POCP and NP

Environmental impacts such as ozone depletion, photochemical ozone creation (summer smog) and eutrophication (excess nitrification of bodies of water by fertilisers) are negligible.

Literature

- In-house document, Life Cycle Assessment POLIM-H, 1HC0034590, Version AA, 2005
- TR 05_75 LCA HV surge arresters, 2005
- MSR: Enclosure A, 1999:1

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