Environmental Product Declaration

for AC- generator type AMG 0900
5125 kVA power

ABB Automation

Organizational framework

Manufacturer:
ABB Industry Oy / Machines Group
P.O. Box 186
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Finland

ABB Industry Oy in Finland is a part of ABB's Automation segment. The company develops, manufactures and markets electrical machines and drives for the ABB Group customers world-wide and is reponsible for several key product groups, including low and high voltage AC machines and generators.

***Environmental management*:**
The ISO 14001 international environmental management standard has been implemented and the Helsinki factory is certified since 1996. Life cycle assessment is applied continuously to all product development.

Helsinki factory has been awarded ISO 9001 quality certification since 1994 in recognition of its commitment to maintaining the high quality of its AC Machines.

Product description:

AMG generators have shaft heights from 710 mm up to 2500 mm. The range of rated output is from 3.5 MVA up to 50 MVA, and voltages are from 1 kV up to 15 kV. Typical applications of the AMG generators are medium speed gas and diesel power plants. This document applies to the AMG 0900, a 5125 kVA, 11 kV product.

Material according to the table below is used for the product:

Type of material	kg / product	kg / kVA
Electro steel	7 120	1.389
Other steel	10 900	2.127
Forged steel	5 323	2.127
Aluminium	13	1.039
Copper	2 461	0.003
Insulation material	155	0.480
Wooden boxes and planks	800	0.030
Impregnation resin	225	0.156
Paint	40	0.008

Environmental performance

The data and calculations are in accordance with Product Specific Requirements (PSR) for Rotating Electrical Machines dated April 2000, which specifies the following baselines for the LCA calculation.

Functional unit
The functional unit for the LCA is 1 kVA of rated output power.

System boundaries
The life cycle assessment covers all environmental aspects for extraction and production of raw materials, manufacturing of main parts, assembly of the machine, transportation and use of the product, dismantling, fragmentation and disposal and recycling of scrap after end of life. It includes consumption of material and energy resources as well as emissions and waste generation.

Calculations are based upon an estimated lifetime of 25 years when operating 6,500 hours per year. A Finnish mix of energy has been used for calculating energy consumption during manufacturing and a European mix of energy for calculating energy consumption during use and disposal.

The operational point chosen for the usage phase is 5125 kVA, 750 rpm and efficiency 97.0 %. The operational point in reality will vary considerably depending on the specific application

Allocation unit

The factor for allocation of common environmental aspects during manufacturing (like manufacturing waste) is calculated as the rated output power of the product in relation to the total annual production volume of the factory.

Resource utilization

	Manufacturing phase unit / kVA	Usage phase unit / kVA	Disposal phase unit / kVA
Use of non-renewable resources			
Coal kg	4.53	1 376.40	-1.10
Aluminium (Al) kg	0.003	0.00	-0.002
Copper (Cu) kg	0.49	0.00	-0.44
Iron (Fe) kg	4.12	0.00	-3,29
Manganese (Mn) kg	0.00	0.00	0.001
Natural Gas kg	0.67	95.17	0.01
Uranium (U) kg	0.001	0.00	-0.001
Oil kg	2.74	144.27	-1.21
Use of renewable resources			
Wood kg	0.16	0.00	0.00
Hydro Power MJ	0.22	0.00	0.00

Energy consumption and losses

	kWh / product			kWh / kVA		
Energy form	**Manufacturing phase**	**Usage phase**	**Disposal phase**	**Manufacturing phase**	**Usage phase**	**Disposal phase**
Electrical energy	40 122	25 757 000	786	7.82	5 025.8	0.15
Heat energy	9 659	-	-	1.88	-	-

The average Finnish electricity mix is defined as being 10% gas, 31% hydro, 40% nuclear, 2% oil and 17% stone coal. The average European electrical energy is defined as being 10% gas, 15% hydro, 36% nuclear, 10% oil, 19% stone coal and 10% lignite coal. The resultant resource utilization is shown in the table above.

Waste	kg / kVA
Hazardous waste after manufacturing phase	
Oil emulsions	0.02
Various	0.01
Hazardous waste after usage phase	
Various	0.01
Regular waste (to landfill)	
During manufacturing phase	0.06
At disposal phase	0.20

The classification data for emissions are as below:

Environmental effect	Equivalent unit	Manufacturing phase	Usage phase	Total life cycle
Global warming potential GWP	kg CO_2 / kVA	23.20	2 526.51	2 539.48
Acidification potential AP	kmol H+ / kVA	0.005	0.50	0.50
Eutrophication	kg O_2 / kVA	0.48	31.67	32.10
Ozone depletion potential ODP	kg CFC-11 / kVA	0.00	0.00	0.00
Photochemical oxidants POCP	kg ethylene / kVA	0.02	0.58	0.59

Additional qualifying factors

Recycling and disposal

The main parts of the product can be recycled. Some parts need to be fragmented to separate different types of material. A list of parts and components that can be fragmented and recycled can be obtained from the manufacturer. See references.

Usage phase in relation to the total

It is to be observed that the environmental impact during the usage phase is the most important. As an example, GWP for the usage phase is approximatively 100 times larger than GWP for the manufacturing phase.

Category of impact	Usage in % of total
Global warming GWP	99.49 %
Acidification AP	99.24 %
Eutrophication	98.68 %
Ozone depletion ODP	-
Photochemical oxidants POCP	97.39 %

References

- LCA report *3BFP 000 017 R0101 REV A*
- PSR 2000:2 for Rotating Electrical machines
- Project specific *User's Manual*
- Recycling and disposal *3BFP 000 018 R0101 REV*
- MSR 1999:2 Requirements for Environmental Product Declarations, EPD from the Swedish Environmental management Council

The above mentioned documents are available upon request.

GLOSSARY

Acidification, AP. Chemical alternation of the environment, resulting in hydrogen ions being produced more rapidly than they are dispersed or neutralized. Occurs mainly through fallout of sulfur and nitrogen compounds from combustion processes. Acidification can be harmful to terrestrial and aquatic life.

Eutrophication. Enrichment of bodies of water by nitrates and phosphates from organic material or the surface runoff. This increases the growth of aquatic plants and can produce algal blooms that deoxygenate water and smother other aquatic life.

Global warming potential, GWP. The index used to translate the level of emissions of various gases into a common measure to compare their contributions to the absorption by the atmosphere of infrared radiation. GWPs are calculated as the absorption that would result from the emission of 1 kg of a gas to that from emission of 1 kg of carbon dioxide over 100 years.

Life cycle assessment, LCA. A management tool for appraising and quantifying the total environment impact of products or activities over their entire life cycle of particular materials, processes, products, technologies, services or activities. Life cycle assessment comprises three complementary components-inventory analysis, impact analysis and improvement analysis.

Ozone depletion potential, ODP. The index used to translate the level of emissions of various substances into a common measure to compare their contributions to the breakdown of the ozone layer. ODPs are calculated as the change that would result from the emission of 1 kg of a substance to that from emission of 1 kg of CFC-11 (a freon)

Photochemical ozone creation, POCP. The index to translate the level of emissions of various gases into a common measure to compare their contributions to the change of ground-level ozone concentration. POCPs are calculated as the change that would result from the emission of 1 kg of a gas to that from emission of 1 kg of ethylene.

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