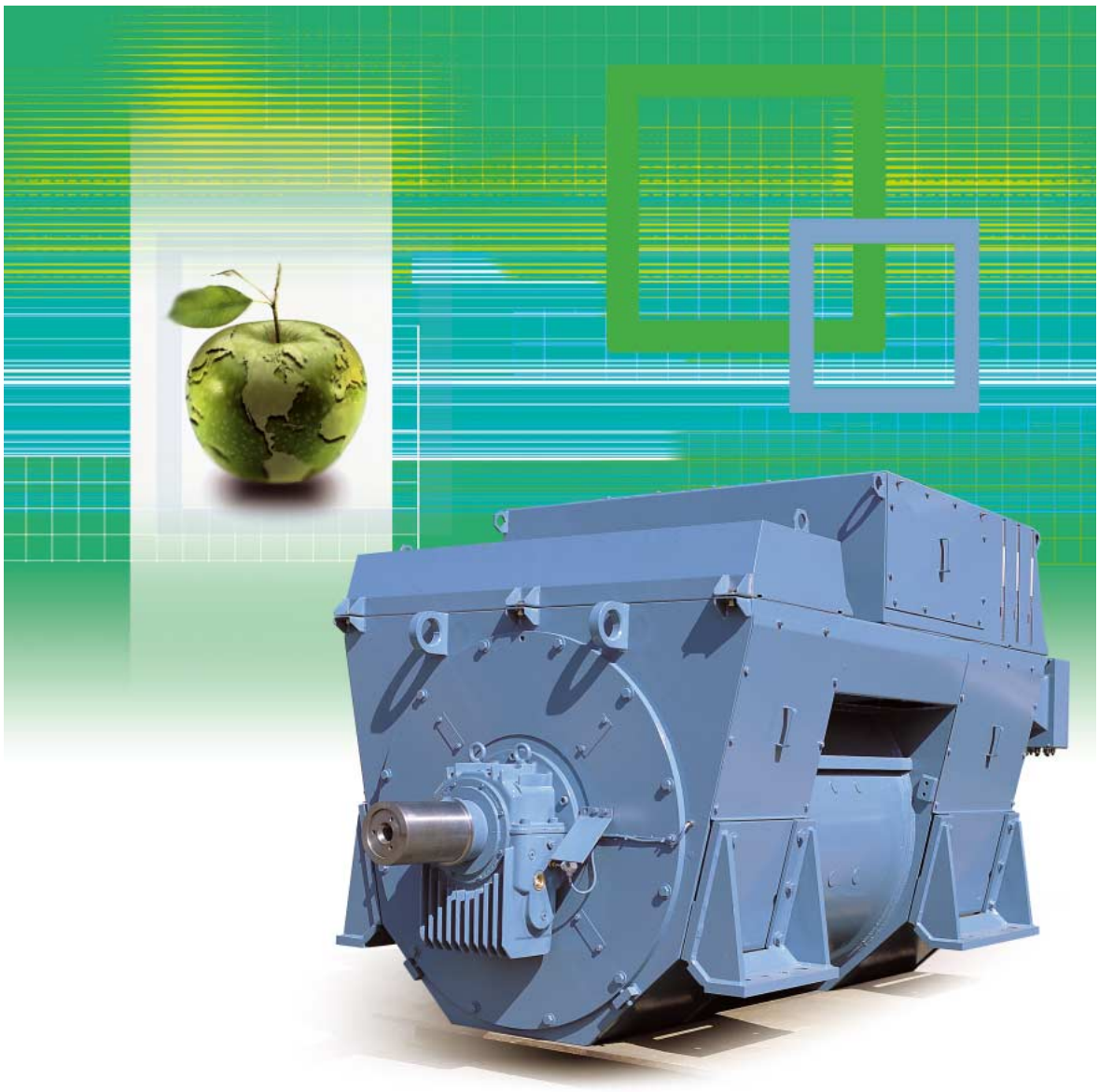
Environmental Product Declaration

AC generator type AMG 0900, 5125 kVA power



Organizational framework

Manufacturer

ABB Oy, Machines
P.O.Box 186, FI-00381 Helsinki, Finland

ABB (www.abb.com) is a leader in power and automation technologies that enable utility and industry customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 108,000 people.

ABB Oy, Machines, forms a part of ABB's Automation Products division. It is designing, manufacturing and marketing induction and synchronous motors and generators for the industry and power production.

Environmental management

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

The Helsinki factory was awarded the ISO 9001 quality certificate in 1994 in recognition of its commitment to maintaining the high quality of its AC Machines.

Product description

AMG generators have shaft heights ranging from 710 mm to 2500 mm. The range of rated output is 3.5 MVA – 50 MVA, and voltage ranges from 1 kV to 15 kV. Typical applications of the AMG generators include gas/diesel engine and wind turbine based power plants. This document applies to the AMG 0900 model, a 5125 kVA, 11 kV product.

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

Type of material	kg/product	kg/kVA
Electrical steel	7120	1.389
Other steel	10 900	2.127
Forged steel	5323	2.127
Aluminium	13	1.039
Copper	2461	0.003
Insulation material	155	0.480
Wooden packing material	800	0.030
Impregnation resin	225	0.156
Paint	40	0.008

Environmental performance

The data and calculations are in accordance with the Product-Specific Requirements (PSR) for Rotating Electrical Machines dated April 2000, which specify 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 lifecycle 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, disposal and recycling of scrap at the end of the product's 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 6500 hours per year. A Finnish mix of energy has been used to calculate energy consumption during manufacturing and a European mix of energy to calculate 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 (such as manufacturing waste) is calculated as the rated output power of the product in relation to the total annual production volume of the factory.

Resource utilisation	Manufacturing phase unit/kVA	Usage phase unit/kVA	Disposal phase unit/kVA
Use of non-renewable resources			
Coal kg	4.53	1376.40	-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	5025.8	0.15
Heat energy	9659	–	–	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 utilisation 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 lifecycle
Global warming potential GWP	kg CO_2/kVA	23.20	2526.51	2539.48
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 must be noted that the environmental impact during the usage phase is the most important. As an example, the GWP of the usage phase is approximately 100 times greater than the GWP of the manufacturing phase.

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

The above-mentioned documents are available upon request.

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 %

GLOSSARY

Acidification, AP: Chemical alternation of the environment, resulting in hydrogen ions being produced more rapidly than they are dispersed or neutralised. Occurs mainly through fallout of sulphur 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 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 of the emission of 1 kg of carbon dioxide over 100 years.

Lifecycle assessment, LCA: A management tool for appraising and quantifying the total environment impact of products or activities over their entire lifecycle of particular materials, processes, products, technologies, services or activities. Lifecycle 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 of the 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 of the emission of 1 kg of ethylene.

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