Environmental Product Declaration

ACS 6000 Medium Voltage AC Drive – for speed and torque control for power of 3 MW to 27 MW motors

Organisational framework

ABB Industrie AG in Switzerland forms a part of ABB's Automation Technology Products division. The company develops, manufactures and markets electrical machines and drives for ABB Group customers worldwide and is responsible for several key product groups, including variable-speed AC drives and drive systems for speed control of electric motors.

Environmental management

The ISO 14001 international environmental management standard has been implemented and the Turgi factory has been certified since 1999. Life cycle assessment (LCA) is applied continually to all product development.

The Turgi factory was awarded the ISO 9001 quality certificate in 1994 in recognition of its commitment to maintaining the high quality of its products and systems.

Product description

ABB Industrie AG, Drives Group comprises the following product lines

- ACS 1000 power range 0.3 to 5 MW
- ACS 6000 power range 3 to 27 MW

This document applies to the ACS 6109 A06 1S9, 9MVA ACS 6000 drive which was assumed to be used with a motor of 5MW power.

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

Type of Material	kg/Product	kg/kW
Aluminium	109	0.012
Copper	1234	0.137
Plastic	537	0.060
Steel	2933	0.326
Iron	48	0.005
Zinc	18	0.002
Other	546	0.061

Environmental performance

The data and calculations are in accordance with Product Specific Requirements (PSR) for Variable Speed Electric Drives, which specifies the following baselines for the LCA calculation.

Functional unit

The functional unit for the LCA is 1 kW 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, 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 on an estimated lifetime of 15 years when operating 5,000 hours per year. A European mix of energy has been used for calculating energy consumption during manufacturing and an OECD mix of energy for calculating energy consumption during use and disposal.

Allocation unit

The factor for allocation of common environmental aspects during manufacturing (such as manufacturing waste) is calculated as used working hours in relation to the total annual production volume for the manufacturing at ABB Industrie AG and mass for the manufacturing at the suppliers.

Resource utilisation	**Manufacturing phase unit /kW**	**Usage phase unit/kW**	**Disposal phase unit/kW**
Use of non-renewable resources (kg)			
Coal	0.37	246.02	0.00
Oil	0.29	20.16	0.00
Gas	0.10	21.04	0.00
Nuclear	0.00	0.01	0.00
Copper (Cu)	0.14	0.00	0.00
Iron (Fe)	0.31	0.00	0.00
Aluminium (Al)	0.01	0.00	0.00
Use of renewable resources (kg)			
Hydro power MJ	0.03	0.00	0.00

Energy consumption and losses	kWh/product			kWh/kW		
Energy form	Manufacturing phase	Usage phase	Disposal phase	Manufacturing phase	Usage phase	Disposal phase
Electrical energy	356.70	7,500,000.00	0.00	0.04	833.33	0.00
Heat energy	0.00	0.00	0.00	0.00	0.00	0.00

The European electricity mix ETH is defined as being 9.6 percent gas, 15.2 percent hydro, 10.5 percent lignite coal, 36.2 percent nuclear, 9.5 percent oil and 18.5 percent stone coal. The average OECD electrical energy mix is defined as being 13 percent gas, 16 percent hydro, 23 percent nuclear, 7 percent oil, 33 percent stone coal, 6 percent lignite coal, 1.5 percent biomass & waste and 0.5 percent other. The resultant resource utilisation is shown in the table above.

Waste	**kg/kW**
Hazardous waste	
During manufacturing	0.00
At disposal phase	0.00
Regular waste (to landfill)	
During manufacturing phase	0.04
At disposal phase	0.60

The classification data for emissions are as follows

Environmental effect	Equivalent unit	Manufacturing phase	Usage phase
Global warming potential (GWP)	kg CO_2 /kW	2.06	504.33
Acidification potential (AP)	kmol H+/kW	0.01	2.88
Eutrophication	kgO_2/kW	0.00	0.14
Ozone depletion (ODP)	kg CFC-11/kW	0.00	0.00
Photochemical oxidants (POPC)	kg ethylene/kW	0.00	0.09

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 should be observed that the environmental impact during the usage phase is the most important. As an example, GWP for the usage phase is approximately 240 times larger than GWP for the manufacturing phase.

Category of impact	Usage in % of total
Global warming GWP	99.46%
Acidification AP	99.62%
Eutrophication	99.02%
Ozone depletion ODP	-
Photochemical oxidants POPC	99.06%

References

- LCA report, ACS 6000, 3BHS 122084
- PSR 2000:7 for Variable Speed Electric Drives, The Swedish Environmental Management Council
- User's Manual for type ACS 6000
- MSR 1999:2 Requirements for Environmental Product Declarations, EPD, The Swedish Environmental Management Council
- ACS 6000 product family, Environmental information, Recycling instructions, 3BHS 122085

The above mentioned documents are available upon request.

GLOSSARY

Acidification, AP. Acidification originates from the emissions of sulphur dioxide and oxides of nitrogen. In the atmosphere, these oxides react with water vapour and form acids which subsequently fall down to the earth in the form of rain or snow, or as dry depositions. Acidification potential translates the quantity of emission of substances into a common measure to compare their contributions to the capacity to release hydrogen ions.

Eutrophication. Nutrients (mainly nitrogen and phosphorus) from sewage outfalls and fertilised farmland accelerate the growth of algae and other vegetation in water. The degradation of organic material consumes oxygen resulting in oxygen deficiency and fish kill. Eutrophication translates the quantity of emission of substances into a common measure expressed as the oxygen required for the degradation of dead biomass.

Global warming potential, GWP. Some of the gases in the earth's atmosphere (in particular water vapour and carbon dioxide) have an ability to absorb infrared radiation. They do not prevent sunlight reaching the earth's surface, but they do trap some of the infrared radiation emitted back into space causing an increase in the surface temperature. Global Warming Potential, GWP100, translates the quantity of emission of gases into a common measure to compare their contributions - relative to carbon dioxide - to the absorption of infrared radiation in 100 years perspective.

Life cycle assessment, LCA. A management tool for appraising and quantifying the total environmental impact of products or activities over their lifetime by analyzing the 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. Ozone forms a layer in the stratosphere protecting plants and animals from much of the sun's harmful UV radiation. The ozone levels have declined as a consequence of CFCs and halons released into the atmosphere. A depletion of the ozone layer will increase the UV-radiation at ground level. Ozone depletion potential translates the quantity of emission of gases into a common measure to compare their contributions - relative to CFC-11 (a freon) - to the breakdown of the ozone layer.

Photochemical ozone creation, POCP. Photochemical ozone or ground level ozone is formed by the reaction of volatile organic compounds and nitrogen oxides in the presence of heat and sunlight. Ground-level ozone forms readily in the atmosphere, usually during hot summer weather. Photochemical ozone creation potential translates the quantity of emission of gases into a common measure to compare their contributions - relative to ethylene - to the formation of photochemical oxidants.

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