Environmental Product Declaration

for ACS 600 frequency converter, 250 kW power

Organisational framework

ABB Industry Oy in Finland forms part of ABB's Automation Technology Products segment. The company develops, manufactures and markets electrical machines and drives for ABB Group customers world-wide 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 Helsinki factory has been certified since 1996. Life cycle assessment is applied continually to all product development.

Product description

ABB Industry Oy, Drives Group comprises the following product lines

- Comp-AC
  - ACS 100 power range 0.12 to 2.2 kW
  - ACS 140 power range 0.12 to 2.2 kW
  - ACS 160 power range 0.55 to 2.2 kW
  - ACS 400 power range 2.2 to 37 kW
- ACS 600 power range 2.2 to 4,300 kW
- SAMI MEGASTAR power range 1 to 8 MW

This document applies to the ACS 604 032 050 00B 000 0901 model which is a 250 kW, 500 V, 365 A product.

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

Type of material	kg / product	kg / kW
Steel	100.82	0.403
Copper	24.39	0.098
Aluminium	34.88	0.140
Plastics	12.50	0.050
Cardboard (package)	19.62	0.078
Other materials	4.47	0.018

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 Finnish 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.

Resource utilisation

	Manufacturing phase unit / kW	Usage phase unit / kW	Disposal phase unit / kW
Use of non-renewable resources			
Coal kg	1.13	800.27	-0.64
Aluminium (Al) kg	0.14	0.00	-0.13
Copper (Cu) kg	0.10	0.00	-0.09
Iron (Fe) kg	0.43	0.00	-0.36
Manganese (Mn) kg	0.00	0.00	0.00
Natural Gas kg	0.19	68.44	-0.04
Uranium (U) kg	0.00	0.02	0.00
Oil kg	0.41	65.40	-0.22
Use of renewable resources			
Hydro Power MJ	0.10	2,024.07	0.00
Wood kg	0.08	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	99.0	677,662.2	-	0.40	2,710.65	-
Heat energy	54.5	-	-	0.22	-	-

The average Finnish electricity mix is defined as being 10 percent gas, 31 percent hydro, 40 percent nuclear, 2 percent oil and 17 percent stone coal. The average OECD electrical energy 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	-
At disposal phase	-
Regular waste (to landfill)	
During manufacturing phase	0.00
At disposal phase	0.09

The classification data for emissions are as follows.

Environmental effect	Equivalent unit	Manufacturing phase	Usage phase	Total life cycle
Global warming potential GWP	kg CO_2 / kW	4.85	1,623.16	1,625.70
Acidification potential AP	kmol H+ / kW	0.00	0.29	0.29
Eutrophication	kg O_2 / kW	0.07	21.69	21.73
Ozone depletion potential ODP	kg CFC-11 / kW	0.00	0.00	0.00
Photochemical oxidants POCP	kg ethylene / kW	0.00	0.29	0.29

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 to be observed that the environmental impact during the usage phase is the most important. As an example, GWP for the usage phase is approximately 340 times larger than GWP for the manufacturing phase.

Category of impact	Usage as % of total
Global warming GWP	99.84 %
Acidification AP	99.81 %
Eutrophication	99.80 %
Ozone depletion ODP	-
Photochemical oxidants POCP	99.61 %

References

- LCA report, 3AFE 64429043
- PSR 2000:7 for Variable Speed Electric Drives
- ACS/ACP/ACC 604/607/627 Hardware manual, 3BFE 61201394
- ACS 600 frequency converter, Environmental Information, Recycling Instructions 3AFE 64428969
- MSR 1999:2 Requirements for Environmental Product Declarations, EPD from the Swedish Environmental Management Council

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, 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.

Ozone depletion, 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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