Environmental Product Declaration

AC machine type HXR 355, 250 kW power

ABB Automation

Organizational framework

Manufacturer

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

ABB Industry Oy/Machines Group Helsinki is part of the Motors & Machines ***Business Unit***, comprising fourteen manufacturing locations around the world. The business unit belongs to the Automation Power Products ***Business Area***, part of ABB's Automation segment.

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

HXR machines have shaft heights ranging from 315 mm to 560 mm. The range of rated output is 100–2250 kW, and voltage ranges from 380 V to 11 500 V. Typical applications of the HXR machines include pumps, fans, blowers, compressors, conveyors, grinders, ship thrusters and AC generators. This document applies to the HXR 355 model, a 250 kW, 6000 V product.

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

Type of material	kg/product	kg/kW
Electrical steel	1252	5.01
Other steel	361	1.44
Cast iron	767	3.07
Aluminium	1.6	0.01
Copper	319	1.28
Insulation material	11	0.04
Wooden packing material	50	0.20
Impregnation resin	16	0.06
Paint	11	0.04

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 kW 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 250 kW, 991 rpm and efficiency 95.3 %. 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/kW	Usage phase unit/kW	Disposal phase unit/kW
Use of non-renewable resources			
Coal kg	11.68	2194.84	-4.53
Aluminium (Al) kg	0.006	0.00	-0.001
Copper (Cu) kg	1.29	0.00	-1.14
Iron (Fe) kg	7.75	0.00	-5.79
Manganese (Mn) kg	0.02	0.00	-0.01
Natural Gas kg	1.97	151.76	-0.08
Uranium (U) kg	0.00	0.09	-0.00
Oil kg	4.78	230.05	3.00
Use of renewable resources			
Wood kg	0.20	0.00	0.00
Hydro Power MJ	0.33	0.00	-0.01

Energy consumption and losses	kWh/product			kWh/kW		
Energy form	**Manufacturing phase**	**Usage phase**	**Disposal phase**	**Manufacturing phase**	**Usage phase**	**Disposal phase**
Electrical energy	2087	2 003 541	136	8.35	8014.16	0.54
Heat energy	780	–	–	3.12	–	–

The average Finnish electricity mix is defined as being 10 % gas, 31 % hydro, 40 % nuclear, 2 % oil and 17 % stone coal. 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/kW
Hazardous waste after manufacturing phase	
Oil emulsions	0.027
Various	0.014
Hazardous waste after usage phase	
Various	0.000
Regular waste (to landfill)	
During manufacturing phase	0.073
At disposal phase	0.500

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/kW	56.66	4028.82	4062.96
Acidification potential AP	kmol H+/kW	0.01	0.80	0.80
Eutrophication	kg O_2/kW	1.41	50.50	51.73
Ozone depletion potential ODP	kg CFC-11/kW	0.00	0.00	0.00
Photochemical oxidants POCP	kg ethylene/kW	0.05	0.92	0.97

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 70 times greater than the GWP of the manufacturing phase.

Category of impact	Usage in % of total
Global warming GWP	99.16 %
Acidification AP	98.73 %
Eutrophication	97.61 %
Ozone depletion ODP	–
Photochemical oxidants POCP	95.32 %

References

- 3BFP 000 016 R0101 REV A, LCA report
- PSR 2000:2 for Rotating Electrical Machines
- HXR 011 G en 9706, Installation and Maintenance Manual
- 3BFP 000 018 R0101 REV A, Recycling and Disposal
- MSR 1999:1 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 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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