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| ABB Automation Technologies | | Recycling Instructions | | DOCRIACS50001 | |
| Product Support, Drives | | ACS 500 product family | | | |
| Department: TLC | Date: 21.12.2004 | Author: Ari Niskanen | Checked / Approved: Mikko Eskelinen | Revision: A | Page: 1 (9) |

ENVIRONMENTAL INFORMATION

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1. Introduction

This document covers the environmental information of the following products:

- ACS 500 product family made in Finland

The document comprises a summary of materials used in the products and instructions how to handle an end-of-life product.

This document is intended for ABB internal use as well as for commercial recyclers.

While environmental regulations vary from country and region to another, and are also evolving rapidly by time, it is recommended to contact local environmental authorities for up-to-date information when consulting with customers or other stakeholders about proper product material recovery or other treatment.

Information for local customers, like where an end-of-life product can be returned, is recommended to be provided with this information.

Further information is available from

ABB Oy
Product Support
P.O. Box 116
FIN-00381 Helsinki
Finland
Telephone +358-10-222 000
Telefax +358-10-222 6803

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2. Product package

Plastic and wood-based materials used in the package can be recycled and other materials can be landfilled. No harmful materials are used in the package.

To avoid pollution caused by unnecessary transportation, the manufacturing factory is not taking back used packages. Package recycling is organized by the importing ABB sales company locally, according to local regulations.

Package recycling is recommended while recycling preserves raw materials and reduces waste being landfilled.

In the following table the packing materials of different package types are listed.

| 1. Standing crate | 2. Seaworthy export packing to Europe | 3. Seaworthy export packing outside Europe (Al-foil) | 4. Seaworthy export packing to Europe and North America (VCI-film) |
|--------------------------|--|---|---|
| Rough board | Rough board | Rough board | Rough board |
| Cardboard | Corrugated board | | |
| | Plywood (birch veneer) | Plywood (birch veneer) | Plywood (birch veneer) |
| | Antistatic PE-film | Antistatic PE-film | |
| | Stretch film | | |
| | PE-film | | PE-film with VCI |
| | | Bubble plastic | Bubble plastic |
| | PC board | | |
| | | | Plastic supports |
| | | Rubber board (optional) | |
| | | Al-foil | |
| Steel strap | | | |
| | VCI paper | VCI paper | VCI paper |
| | Desiccant | Desiccant | |
| | Silicone seal | Silicone seal | |

For abbreviations, see Chapter 3.

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3. Product materials

ACS 500 frequency converter consists of the following units.

| | |
|-----|---|
| RU | RECTIFIER UNIT (INCLUDING CAPACITOR BANK) |
| INU | INVERTER UNIT |

| | |
|------------------------|---|
| <u>RECTIFIER UNIT</u> | |
| Rectifier | Cu, Al, Si, Mo, Q, ceramic, Fe, Ni, Rh, PUR, PP, PC, UP |
| Power semiconductors | Cu, Si, Mo, Q, ceramic, Ni, Rh |
| Electrolytic capacitor | Al, electrolytic solute |
| Choke | Fe, Cu |
| <u>INVERTER UNIT</u> | |
| Motor Control board | GF, Cu, Sn, plastic |
| Main Interface board | GF, Cu, Sn, plastic |
| Power Semiconductors | Epoxy, Cu, Al, Si, Si gel, PBT, Pb, PPS, SiN, AlN |
| Heatsink | Al alloy (Mg, Si) |
| Fan | PBT, PA, Cu, Al |

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| | |
|---------------------------------|---|
| <u>MECHANICS</u> | |
| Terminal blocks, socket-outlets | Steel, brass, Cu, plastic |
| Wires, cables | Cu, Sn, PVC, Si |
| Optical fibres & connectors | Plastic |
| Screw connection equipments | Zn-coated steel |
| Screws | Zn coated steel |
| Doors, side & roof plates | Zn-coated steel, polyester powder paint |
| Cover plates, cover strips | Galvanised steel , paint |
| Lifting bars | Steel, paint |
| | |
| | |

Abbreviations

| | |
|----------|------------------------------|
| Brass | Cu,Zn |
| Ceramics | Mg- and Al- oxides |
| GF | Glasfibre |
| PA | Polyamide |
| PBT | Polybutylenetrephtalate |
| PC | Polycarbonate |
| PCB | printed circuit board |
| PE | Polyethylene |
| PP | polypropylene |
| PPS | polyphenylenesulfide |
| PUR | Polyurethane |
| PVC | Polyvinyl chloride |
| Q | silicone (rubber) |
| UP | unsaturated polyester |
| VCI | volatile corrosion inhibitor |

3.3 Product manuals and sales brochures

All brochures and manuals can be recycled.

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4. Product use

The use of a frequency converter has several positive environmental impacts, like:

- Substantial energy savings can be reached using a frequency converter. According to investigations, these savings are in pump and fan drives typically 50 %. This means reduced CO₂ and NO_x emissions in power plants, due to reduced energy demand.
- Process controllability is improved when a state-of-the art drive is used as a part of a process control system, meaning reduced waste
- When a process can be driven in an optimal way, process equipment's (like conveyors' and pumps') wearing is reduced and life time increased, decreasing environmental loading caused by manufacturing new equipment
- Noise is in most cases reduced
- Natural resources like wood in pulp & paper industry are saved while process efficiency is improved

The frequency converter itself does not cause any emissions while in use. Due to reduced energy consumption, overall harmful emissions are reduced as described above.

For more information on product use, see User's Guide.

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5. Product disposal

Product disposal can be made in two alternative ways. The product can be disassembled manually or crushed in a shredding machine.

5.1 Manual disassembly

The product is disassembled manually and parts are sorted according to their material contents as follows:

- iron metals (cabinets)
- aluminum (heatsinks)
- plastics
- printed circuit boards*
- other*

* For more information, see 5.3 List of potentially harmful materials

Metal parts (iron, copper and aluminum) can easily be recycled, other materials according to local arrangements.

5.2 Mechanical shredding

In this method, a whole product is mechanically shredded into small pieces and materials are sorted using dedicated sorting processes. Components containing harmful materials must, however, be removed before shredding (for more information, see 5.3 List of potentially harmful materials).

5.3 List of potentially harmful materials

Definitions and regulations of hazardous materials differ from country to country and are also changing when knowledge of materials increases. The materials used in the product are materials typically used in electric and electronic devices.

The list given below is based on the following references:

1. CEFIC-EECA-EICTA. Excerpts of restrictions on substances from legal provisions for special application in electric and electronic products. May 02, 2002.
2. Substances contained in products of the electrical/electronics industry. Zentralverband Elektrotechnik- und Elektronikindustrie (ZVEI) e.V., Frankfurt am Main. 1995.
3. Commission of the European Communities. Proposal for a directive of the European Parliament and of the Council on waste electrical and electronic equipment. 2000/0158 (COD) 13.6.2000.
4. Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste. (2000/532/EC). "European Waste Catalogue".

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Table: List of possibly harmful substances in different materials and components after previously mentioned references

| Component | Harmful substance(s) | Reference |
|-------------------------|---|-----------|
| Printed circuit boards | lead (in solder) | 1 2 3 |
| | tetrabromobisphenol A (TBBA, flame retardant) | 1 2 3 |
| Plastics | None | |
| Metals | None | |
| Electromechanics | None | |
| Cables | PVC | 1 |
| Electrolytic capacitors | May contain harmful chemicals (DMAC/DMF)* | |

* composition varies with the manufacture and technical development of the electrolytic capacitors
N/A = not available

Note. According to the "European Waste Catalogue", an end-of-life product is classified by code 16 02 14.

Printed circuit boards and electrolytic capacitors, removed from the product, are however classified as "hazardous components removed from discarded equipment", code 16 02 15, requiring special treatment.

5.4 One recycling method

The procedure described below complies with regulations valid in Finland in January, 2002.

- | | |
|---------------------------|--|
| • steel | recycled as material |
| • aluminum | recycled as material |
| • plastics | energy recovery (incineration) or landfilled |
| • printed circuit boards | sent for hazardous material treatment |
| • electrolytic capacitors | sent for hazardous material treatment |
| • cables | landfilled |
| • other materials | energy recovery (incineration) or landfilled |

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6. Manufacturing

The product is manufactured by ABB Oy, Helsinki. The environmental system of the manufacturing unit is certified to ISO 14001.

The accessories and option modules are manufactured by other manufacturers, mainly in Finland.

7. Environmental management system of ABB Oy

Environmental management system (EMS)

ABB Oy has an environmental system covering all divisions and functions of the company. The EMS is certified to ISO 14001 since November, 1996.

The company's environmental objectives include among others items as follows,

- reduce use of material in products, difficult to recycle or reuse
- improve recyclability of products
- reduce environmental burden caused by packaging materials.

ABB Oy's environmental policy

ABB Oy is committed to an environmental policy, which is based on the following:

1. We develop and manufacture products such as alternating current electrical drives and automation systems that save our customers energy and raw materials and give them better control over their processes. We strive continuously to make our products environmentally more sound by applying results obtained in recyclability and life-cycle assessments.
2. We are committed to reducing the harmful environmental impacts of our operations by continuously improving the operation of our production processes.
3. Our minimum requirement is to abide by all acts, decrees and official regulations on environmental protection in all our operations; we aim to ensure that all our subcontractors do likewise. We work closely with our suppliers in seeking environmentally sound solutions.
4. We regularly review the substance and practice of our environmental policy in the light of our environmental management system, setting new environmental goals and targets annually. We regularly inform our staff and other affiliated groups about our environmental concerns, and make sure that our environmental policy is available to the public.
5. Our environmental management system, certified to ISO 14001, is the tool for carrying out our environmental policy. The line organisation, assisted by the environmental organisation, is responsible for ensuring that we fulfil our obligations with respect to environmental protection. In raising and maintaining the environmental awareness of our staff, we assign high priority to training.