

Product-Category Rules (PCR)
for preparing an environmental product
declaration (EPD) for

AC Motors

PCR 2010:1.0

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Industrial Technology Research Institute
Environment and Development Foundation

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1. General Information

This document is to be used as the product category rules (PCR) for AC motors. The requirements specified in this PCR are intended to be used for EPDs certified in accordance with the ISO 14025 standard. This document shall be valid for three years after the completion of revision following the expert review meeting.

This PCR was prepared by the Tatung Co and was discussed during the consultation meeting organized by the Taiwan Electrical and Electronic Manufacturers Association (TEEMA) on May 7, 2010. During the meeting, representatives from major Taiwanese manufacturers of similar products and stakeholders were invited to participate in the discussion and review of this PCR, EDF then reviewed and approved this PCR.

For further information concerning this PCR, and response to stakeholder feedback, please contact Mr. Chin-Chiang Wang of the Tatung CO., Motor Business Unit, Motor Plant, Manufacturing Technical Group, at Tel : 02-86766888 ext: 265 , Fax : 02-86766888 ext: 262 ; email : jerry@sansha.tatung.com.tw) °

2. Company and product description

The EPD shall include information about the manufacturing company/organization. The information may include manufacturing process related information, and environmental related information, such as the environmental management system information. The information may also include special issues which the company/organization would like to emphasize, such as the product meeting certain environmental criteria, or environmental safety and health related information.

This PCR covers the AC motor products, and the products denoted here also include their packaging.

2.1 Product function

AC motors are widely used in various mechanical equipment and electrical products. They are capable of converting electrical energy into mechanical energy in the forms of rotation, vibration or linear movements and are widely used in almost all industries, including the semiconductor, automation, mechanical tools, stamping, injection molding, steel, and pumping industries, etc.

The IEC 60072-1 standard classifies AC motors into three size categories based on their frame sizes:

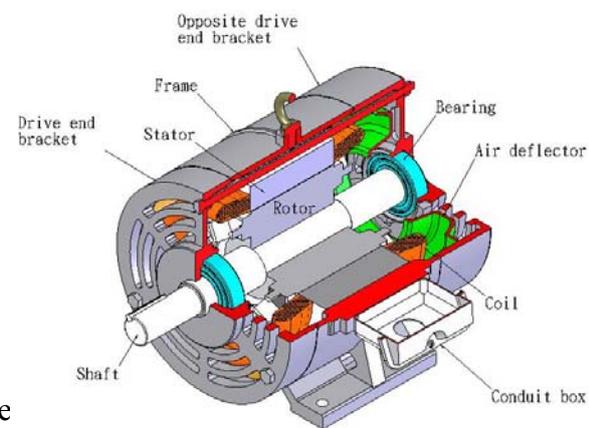
1. Small: #63~#160
2. Medium: #180~#355
3. Large: > #400

For motors not defined by the IEC 60072-1, other international specifications may be adopted.

2.2 Product components

AC Induction Motor (AC Motor) The basic components include:

1. Stator assembly –
frame stator lamination stack and coil
2. Rotor assembly –
shaft, rotor lamination stack and bearing
3. Bracket assembly –
Drive end bracket or flange, opposite drive end bracket
4. Conduit box assembly –
upper of conduit box, base of conduit box, T board, terminals



5. Optional – Thermal protection, space heaters , terminal block
- The data quality requirements for the main components are described in Section 9 on calculation rules and data quality requirements. The EPD shall also include the other components of the AC motors, but their data quality requirements are different from those of the main components.

2.3 Product technical description

In the technical description for the product, it should include the following information:

1. Name
2. Insulation class (ie A, E, B, F, or H class)
3. pole
4. Rated output power kW or HP
5. Rated voltage (V)
6. Rated frequency (Hz)
7. Current (full load current of the approximation to A that)

8. Speed (rated output power RPM of approximation to said rpm)
9. Torque type [normal (N) or high torque (H)]
10. Protection of Enclosure (IP code)
11. Cooling method (IC code)
12. Motor type
13. Manufacturing number or series numbers
14. Manufacturer maker or trademark
15. Year of manufacture
16. Full load efficiency
17. Operation type
18. Design life

3. List of parts and banned substances

The contents of the following parts and substances in the product shall be declared:

- All parts with weight ratio (part weight/product weight) $\geq 0.5\%$; this is the criterion used to determine if a part/component is considered main component;
- All banned substances regulated by legal and customer requirements;
- The following materials in the main components: flame retardants, lead content in solder, lead and flame retardant content in solder masking agent, and substances regulated by RoHS Directive .

The declaration of halogen-free flame retardants, lead-free solders and no RoHS-regulated substances may only be made when appropriate evidences are available (for example, test reports from accredited laboratories/testing facilities). The following organizations may provide accreditation for certification organizations: Taiwan Accreditation Foundation (TAF), (Asia Laboratory Accreditation Cooperation (APLAC), International Laboratory Accreditation Cooperation (ILAC) or ILAC Mutual Recognition Arrangement (ILAC MRA). For definitions of testing methodology and confirmations of regulated hazardous substances based on the accredited laboratories' product testing methods, please refer to the IEC 62321 Standard.

4. Declared unit

The declared unit is defined as one unit AC motor, as the AC motors are marketed and sold in such a unit.

5. System boundaries

The system boundaries of the product system are presented as follows:

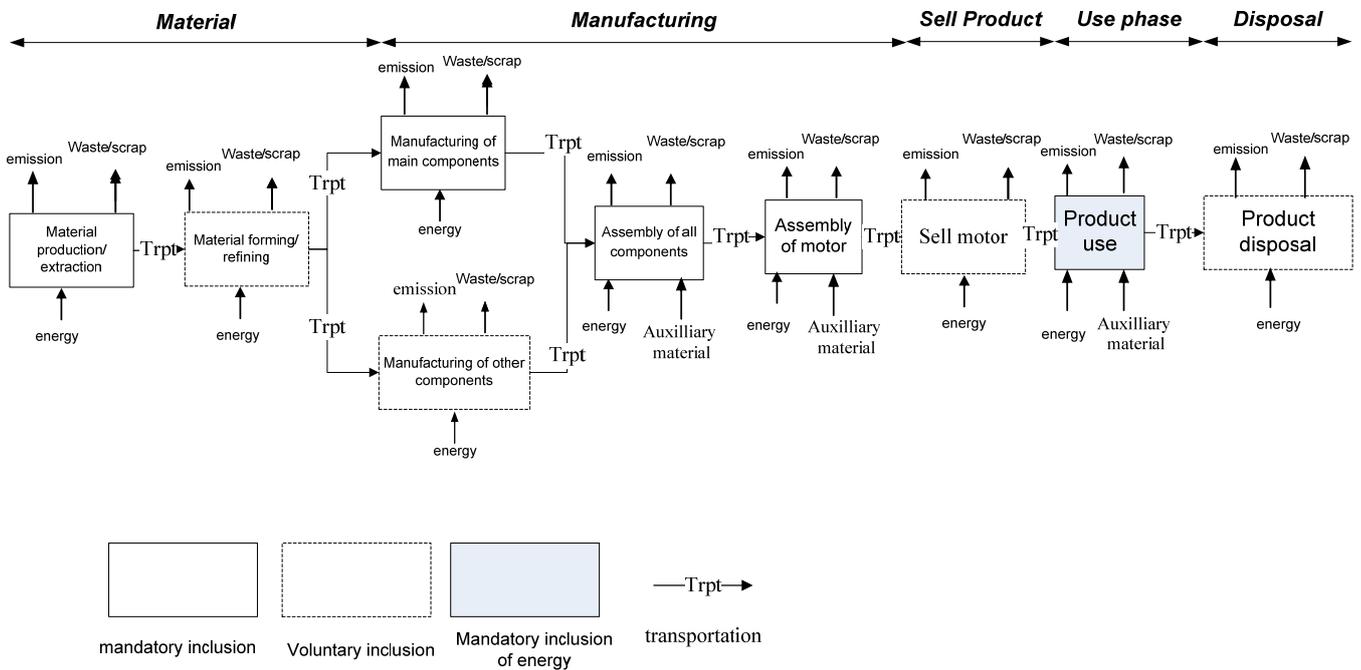


Figure 1 System boundary of the main product system

As described in the Figure 1 above, the life cycle of an AC motor covers the product manufacturing, use and waste disposal phases. It does not include the human resource required in the manufacturing and preparatory manufacturing process, commuting of the workers to and from the work site, and vehicles providing transportation services. Provision of recycling information is of voluntary declaration nature (see Section 11). Basic components are as defined in the Section 2.2 of this PCR.

Raw Materials Acquisition Phase

During the LCA, the following information should be included into the unit processes:

- The extraction and acquisition of raw materials for basic components and other small parts (e.g. warning label, and oil-filling label).

The inclusion in the LCA the information on the material forming and refining and manufacturing of smaller parts is of voluntary reporting nature. When voluntarily reported information is included, they shall be explained in the EPD.

Manufacturing Phase

The LCA shall include information for the following unit processes:

- Product manufacturing
- Product assembly

Sale Phase

- Transportation of basic components to product manufacturer
- Transportation of finished products to customers or downstream manufacturers

Use Phase

This phase is defined as the phase when the AC motor converts electrical energy into mechanical energy and drive a specific product to work.

If the use of an AC motor is known:

This phase should be linked with the application of the product the motor drives. The description of the use phase should follow the PCR of the product which use the AC motor, the EU EuP study reports or the ENERGY STAR testing requirements.

If the use of an AC motor is unknown:

Based on the requirements of the ASTM Standard D2304, for an AC motor under fixed load and reaching thermal equivalent, define the typical motor use as an 8-hour day, 365 days a year, for 7 years.

Recycling/end of life

The reporting of recycling information (such as recycling and dis-assembly report and information on recycling channels) is recommended in the EPD.

5.1 Specification of different boundary settings

Boundary in time

The validity period for the LCA results presented in the LCA report shall be defined.

Boundary towards nature

If the manufacturing processes are located within Taiwan, the waste categories as defined in Taiwan's Waste Disposal Act shall be adopted. If the processes are located in other countries, equivalent legal requirements shall be considered.

The natural boundary of the system shall describe the boundary where the materials and energy resources flow from nature into the system, and where the water and air emissions and waste are released out of the system.

Only the waste which is required to be disposed of needs to be considered; the landfilling process does not need to be included. If the waste will be treated through water treatment or incineration, these processes need to be included.

Boundaries in the life cycle

The boundaries in the product life cycle are described in the Figure 1. The construction of the site and infrastructure, as well as the production of manufacturing equipment and activities of the workers, do not need to be included.

Boundaries towards other technical systems

Boundaries towards other technical systems describe the inputs of material and other components towards other systems, as well as outputs of materials towards other systems. For the inputs of recycled materials and energy towards the product manufacturing phase, the transportation between the recycling process and use of recycled materials shall be included in the data set. For the production of recyclable products during the manufacturing phase, the transportation towards the recycling process shall be included.

(Note: Further explanations are provided in Section 7 on open-loop recycling)

Boundaries regarding geographical coverage

The manufacturing phase may cover manufacturing processes located on any sites around the world. For processes located in a specific region, the data used should be representative of the region. The data for the main components shall be the specific regional data for the region where the process takes place (see Section 9). For ease of comparison, no matter where the emissions are generated, the same parameters should be used for life cycle impact assessment (see Section 10).

6. Cut-off rules

For any impact category, if the sum of various impacts from a specific process/activity is less than 1% of the impact equivalent in that category, such a process/activity may be neglected during the inventory analysis. Parts and materials

omitted from the LCA shall be documented.

(Note: This judgment for this “1% Rule” is based on the environment relevance assessment of material input to the system, and does not consider special and exceptional environmental impacts.)

7. Allocation rules

The main allocation rules shall be valid for the entire product system. For other secondary processes, other allocation rules may be defined; however, the use of these rules should be justified. Product-specific information should be preferentially collected in order to avoid the need for allocation.

While selecting allocation rules, the following principles are recommended:

- Multi-output: The allocations are based on the changes in the resource consumption and pollutant emissions (for example, adopted quantity allocation for some main component, or surface allocation for some components), following the changes in the studied system’s output product or function or economical relationship.
- Multi-input: The allocation is based on actual relationship. For example, the manufacturing process’s emissions may be affected by the change in waste flow input.
- Open loop recycling: For the input of recycled materials or energy during the manufacturing phase of the product system, the transportation between the recycling process and the recycling to material use shall be included in the dataset. For the product which shall be recycled during the manufacturing phase, the transportation towards the recycling process shall be included.

Notes:

- *Allocation may be avoided through avoidance of dividing processes, for example as described in Section 6.3 of ISO/TR 14049; or through expansion of system boundary (for example as described in Section 6.4), so that the amended system shares the same product exchanges as the original system.*

8. Units

The base units and derived units of the International System of Units (Système International d'unités) shall be used preferentially.

Power & energy units:

- power unit use W
- energy units use J

Specification units:

- length unit use m
- capacity units use m³
- area units use m²
- weight units use kg

If necessary, prefixes may be used before the SI units.

10⁹ = giga, symbol “G”

10⁶ = mega, , symbol “M”

10³ = kilo, symbol “k”

10⁻² = centi, symbol “c”

10⁻³ = milli, symbol “m”

10⁻⁶ = micro, symbol “μ”

10⁻⁹ = nano, symbol “n”

9. Calculation rules and data quality requirements

- Site-specific data (for example, specific factory data or transportation data for a specific manufacturing process) shall be used for the production of main components and main assembly. If other types of information are information is used, description of the information and rationale for using the information shall be provided.
- Generic data may be used in the manufacturing process for the AC motor’s smaller (not main) components. Generic data may also be used for the production of bulk materials (see Appendix I for sources of generic data). For example, when bulk raw materials are purchased from the spot market and during waste processing; or when suppliers refuse to provide specific data. The general rule is that if generic data are used in place of specific data, their combined contribution for all life cycle phases shall not greater than 10% or the primary data used should be at least 90%. However, for some specific products, there may be exception.
- The data shall be representative for the average of a specific year.

Data quality requirements for the manufacturing phase

- Site-specific data shall be used for the manufacturing of the product’s main

assembly and main components.

- The electricity mix for the manufacturing phase should be site-specific data. If site-specific data can not be obtained, the official electricity mix for the country where the site is located may be used as approximate value. The electricity mix should be documented.
- For the definition of hazardous waste, the definition as defined in Taiwan's Waste Disposal Act should be used for sites located in Taiwan. For sites located outside Taiwan, legal requirements for the host country shall be observed.
- For the transportation of manufacturer, the transportation modes and distances used by the suppliers shall be considered.

10. Parameters to be declared in the EPD

For the manufacturing phase, the following parameters shall be declared (reported to two decimal places, in scientific notations):

Energy Use MJ

Resource Use

Use of non-renewable resources:

Use of renewable resources:

Impact equivalents expressed as potential environmental impacts

-Global warming kg CO₂ equivalent

-Acidification kg SO₂ equivalent

Additional information

Recyclable materials (optional)

Information on secondary materials (optional)

Waste (classification):

- Hazardous waste as defined in Taiwan's Waste Disposal Act. Follow host countries' laws for sites outside Taiwan.
- Other waste.

11. Recycling information

The recycling information shall include information such as dis-assembly instructions, which parts/components are suitable for recycling (such as metal cases) or not suitable for recycling (for example, the information requirements for the final product manufacturers contained in the WEEE Directive may also be included in the AC motor's EPD).

Information for the parts which can not be recycled and therefore should be disposed of properly during the end-of-life phase may also be included.

12. Other environmental information (Optional)

The EPD may cover information including technology adopted, site of product manufacturing and assembly, as well as information on other working environment, health and risk-related aspects.

If this PCR is to be used for product carbon footprint declaration purpose, in the declaration, information regarding commitment on GHG reduction shall be included and shall ensure that the commitment is measurable, reportable and verifiable. The organization may also list environmental and energy management related information, such as awards, commendations and system certifications (e.g. QC08000 IECQ HSPM) etc.

Businesses' commitment to reducing environmental impacts, such as reducing GHG emissions (mandatory disclosure in some national legislation)

13. Information about the certification

The information on PCR review, EPD verification and verification organization shall be included.

EPD Certification is valid until 2013-__-__

According to the Requirements for the international EPD system, General Programme Instructions, version 1 (2008) – www.environdec.com

The PCR review for _____ (PCR 2010:) was administered by the Environment and Development Foundation and carried out by an LCA expert panel chaired by Dr. Ning Yu (ningyu@edf.org.tw)

Independent verification of the declaration, according to ISO 14025:2006

Internal External

Third party verifier : Environment and Development Foundation, Taiwan.

Accredited by :

Name:

Title:.....

Organization:..... Signature:.....

Name:

Title:.....

Organization:..... Signature:.....

Name:

Title:.....

Organization:..... Signature:.....

Environmental declarations from different programmes may not be comparable.

14. References

The EPD shall make reference to the following documents:

- EPD General Program Instructions, Version 1.0 (2008-02-29), The International EPD Cooperation, downloadable from <http://www.gednet.org>;
- Relevant PCR documents;
- The underlying LCA report.

When available, the following documents shall also be referenced:

- Other documents and recycling instructions which verify and complement the EPD.

For IEC standard, refer to:

- IEC 60072-1 Dimensions and output series for rotating electrical machine-Part 1
Frame numbers 56 to 400 and flange numbers 55 to 1080-6.1 FIXING DIMENSIONS

Appendix I – Generic Data Sources to Refer to

For processes located within Taiwan, the Taiwan generic data or the data published by the commercial, industrial and energy competent authorities of the Republic of China (ROC) government, may be used. However, for other regions (such as EU), if there are more relevant generic data available, these data should be used instead. When data from the following generic databases are used, the most current and updated data should be used:

Material	Database	Published
Taiwan LCA Database	DoITPro	2008
Steel	IISI (International Iron and Steel Institute)	1998
Copper	ICA (International Copper Association)	1998
Copper semi products	ICA (International Copper Association) + IME (Institut für Metallhüttenwesen und Elektrometallurgi, Aachen)	1998 1995
Electricity	ETH (Eidgenössische Technische Hochschule) Data combined with IEA (International Energy Agency) statistics 1998	1996
Aluminum	EAA (European Aluminum Association)	2000
Plastics (and some chemicals)	APME (Association of Plastics Manufacturers in Europe)	1993-1998
Electronic components	EIME (Environmental Information and Management Explorer) EcoBilan	1998-2000
Energy	Boustead model 5.0	2007
Industrial processes	Ecoinvent 2nd edition	2007
Energy	ETH ESU 96	2004
Packaging materials, transport, waste treatments	BUwAL 250, 2nd edition	2004

Appendix II – Reporting Format for the EPD

This appendix provides guidance information for the titles of sections, types of data and required information to be reported in the mandatory reporting part of the EPD. As a generic reporting template, the following titles and sub-titles are recommended:

(Refer to the PCR manual for the section numbering, the information in Italics are the recommended data/information for inclusion)

Introductory part

Each EPD should have an introduction part on the top part of the EPD which includes the following information:

- *Company/organization name*
- *Product name*
- *EPD registration number*

Description of the company/organization and product/service

Company/Organization

- *Description of company/organization*
- *Description of overall working environment, existing quality system and environmental management system*

Product and services (see PCR Section 2)

- *Product's main application*
- *Description of product specification, manufacturing process, manufacturing sites (if there are several sites)*
- *For product's environmental performance aspects, characteristics which may improve the usefulness of product*
- *Other types of relevant information, for example, special manufacturing processes with special advantages*

List of materials and chemical substances

- *Content declaration (see PCR Section 3)*

Presentation of the environmental performance

- *Outline of the LCA methodology, for example, period of LCA, functional units, system boundaries (graphical presentation), cut-off and allocation rules, and data sources.*

Manufacturing phase (see PCR Section 10)

Use phase (see PCR Section 10)

- *Geographical region for product delivery*
- *Transportation data*
- *End-of-life information*

Information about Company and Certification Organization

Recycling information (see PCR Section 11)

Other environmental information (see PCR Section 12)

Information regarding certification

- *Names of certification and verification organizations*
- *Validity of certification certificates*
- *Compliance with legal and relevant requirements*

References (see PCR Section 13)

- *relevant PCR documents*
- *EPD Requirements, MSR 1999 : 2*
- *underlying LCA study*
- *other supporting documents for LCA information*
- *other relevant documents regarding company/organization's environmental activities*