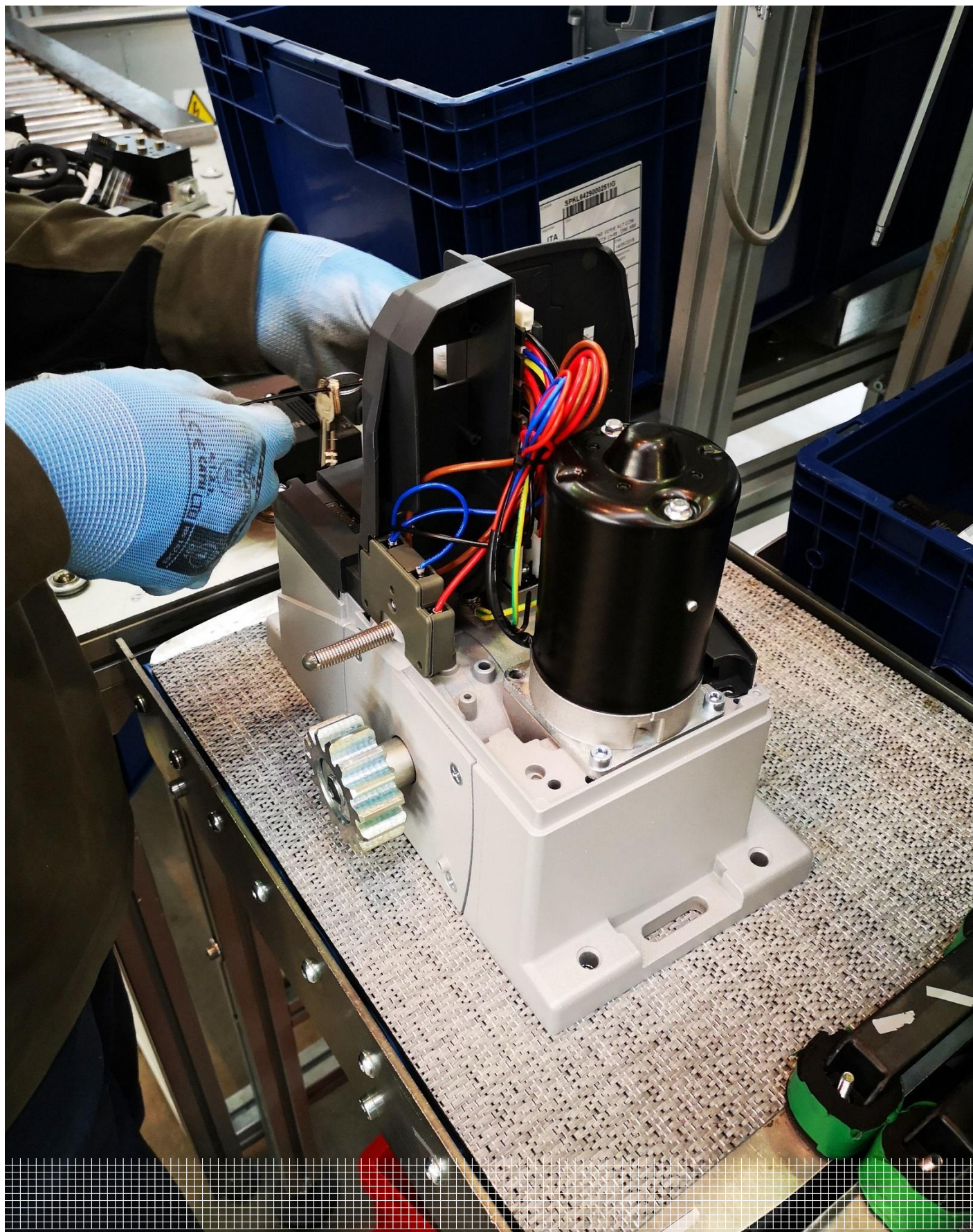


## AC AND DC GEAR MOTORS FOR AUTOMATION SYSTEMS

PRODUCT CATEGORY CLASSIFICATION: UN CPC 46111 AND 46112

PCR 2019:11  
VERSION 2.0.0

VALID UNTIL: 2029-10-20



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# 1 INTRODUCTION

This document constitutes Product Category Rules (PCR) developed in the framework of the International EPD System: a programme for Environmental Product Declarations (EPD)<sup>1</sup> according to ISO 14025:2006, ISO 14040:2006, ISO 14044:2006, and product-specific standards, such as EN 15804 and ISO 21930 for construction products. EPDs are voluntary documents for a company or an industry association to present transparent, consistent, and verifiable information about the environmental performance of their products (goods or services).

The General Programme Instructions (GPI), publicly available on [www.environdec.com](http://www.environdec.com), includes the rules for the overall administration and operation of the programme and the basic rules for developing EPDs registered in the programme. A PCR complements the GPI and the normative standards by providing specific rules, and guidelines for developing an EPD for one or more specific product categories (see Figure 1), thereby enabling the generation of consistent EPDs within a product category. A PCR should not repeat the rules and guidelines of the GPI, but include additions, specifications and deviations to the rules set in the GPI. As such, a PCR shall be used together with the GPI.

This PCR is a main PCR that may be complemented with one or several complementary PCR (c-PCR). If there is an applicable and valid c-PCR, it shall be used in case it has been valid for at least 90 days when the EPD is verified<sup>2</sup>. If it has been valid for less than 90 days, it is optional to use the c-PCR. The valid c-PCRs can be found on [www.environdec.com](http://www.environdec.com).

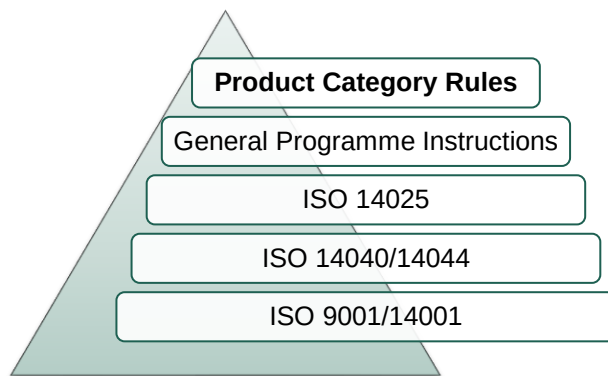


Figure 1. The hierarchy between PCRs, standards, and other documents.

The present PCR uses the following terminology:

- The term “shall” is used to indicate what is obligatory, i.e., a requirement.
- The term “should” is used to indicate a recommendation. Any deviation from a recommendation shall be justified in the EPD development process.
- The terms “may” or “can” are used to indicate an option that is permissible.

For definitions of other terms used in the document, see the GPI and normative standards.

Any references to this PCR shall include the PCR registration number, name, and version number.

The programme operator maintains the copyright of the PCR to ensure that it is possible to publish, update, and make it available to all organisations to develop and register EPDs. Stakeholders participating in PCR development should be acknowledged in the final document and on the website.

<sup>1</sup> Termed type III environmental declarations in ISO 14025.

<sup>2</sup> This does not apply when the EPD is re-verified during its validity, unless the validity period is extended.



## 2 GENERAL INFORMATION

### 2.1 ADMINISTRATIVE INFORMATION

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:                            | AC and DC gear motors for automation systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Registration number and version: | 2019:11, version 2.0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Programme:                       |  <b>EPD</b> ®<br>The International EPD System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Programme operator:              | EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden.<br>Website: <a href="http://www.environdec.com">www.environdec.com</a><br>E-mail: <a href="mailto:support@environdec.com">support@environdec.com</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| PCR Moderator:                   | Simona Canzanelli, <a href="mailto:simona.canzanelli@ambienteitalia.it">simona.canzanelli@ambienteitalia.it</a> , Ambiente Italia S.r.l.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| PCR Committee:                   | Nice S.p.A., Ambiente Italia S.r.l.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Publication date:                | 2025-10-20<br>See Section 9 for a version history of the PCR.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Valid until:                     | 2029-10-20<br>The validity may change. See <a href="http://www.environdec.com">www.environdec.com</a> for the latest version of the PCR and the latest information on its validity and transition periods between versions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Development and updates:         | <p>The PCR has been developed following ISO 14027, including public consultation and review. The rules for the development and updating processes are described in Section 9 of the GPI.</p> <p>The PCR is valid for a pre-determined time period to ensure that it is updated at regular intervals. When the PCR is about to expire, the PCR Moderator shall initiate a discussion with the Secretariat on if and how to proceed with updating the PCR and renewing its validity. A PCR may be updated before it expires, based on changes in normative standards or provided significant and well-justified proposals for changes or amendments are presented.</p> <p>When there has been an update of the PCR, the new version should be used to develop EPDs. For small updates (change of third-digit version number), the previous version is normally immediately removed from the PCR library on <a href="http://www.environdec.com">www.environdec.com</a> and there is no transition period. For medium updates (change of second-digit version number), the previous version of the PCR is valid in parallel during a transition period of at least 90 days, but not exceeding its previously set validity period. For large updates (change of first-digit version number), the previous version is valid in parallel during a transition period of at least 180 days, but not exceeding its previously set validity period.</p> <p>Stakeholder feedback on PCRs is very much encouraged. Any comments on this PCR may be sent directly to the PCR Moderator and/or the Secretariat during its development or during its period of validity.</p> |

AC AND DC GEAR MOTORS FOR AUTOMATION SYSTEMS  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 46111, 46112

|                                      |                                                                                                                                     |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Standards and documents conformance: | General Programme Instructions of the International EPD System, version 5.0.1, based on ISO 14025 and ISO 14040/14044. <sup>3</sup> |
| PCR language(s):                     | At the time of publication, this PCR was available in English.                                                                      |

2.2 SCOPE OF PCR

2.2.1 PRODUCT CATEGORY DEFINITION AND DESCRIPTION

This document provides Product Category Rules (PCR) for the assessment of the environmental performance of AC and DC gear motors for automation systems and the declaration of this performance by an EPD. The product category corresponds to subsets of the following UN CPC subclasses:

- UN CPC 46111 - Motors of an output not exceeding 37.5 W; other DC motors; DC generators
- UN CPC 46112 - Universal AC/DC motors of an output exceeding 37.5 W; other AC motors; AC generators (alternators).

Table 1. UN CPC Classification Hierarchy

| United Nations Central Product Classification |        | UN CPC 4611                                                                                                |
|-----------------------------------------------|--------|------------------------------------------------------------------------------------------------------------|
| Section:                                      | 4 -    | Metal products, machinery and equipment                                                                    |
| Division:                                     | 46 -   | Electrical machinery and apparatus                                                                         |
| Group:                                        | 461 -  | Electric motors, generators and transformers, and parts thereof                                            |
| Class:                                        | 4611 - | Electric motors, generators and the like                                                                   |
| Subclasses                                    | 46111  | <b>Motors of an output not exceeding 37.5 W; other DC motors; DC generators</b>                            |
|                                               | 46112  | <b>Universal AC/DC motors of an output exceeding 37.5 W; other AC motors; AC generators (alternators).</b> |

For additional information, please refer to <https://unstats.un.org/unsd/classifications/Family/Detail/1074>

The product category includes all the electrical equipment (gear motors) which are designed to assure the movement of an opening/closing system. It refers to a product composed by electronic and mechanic parts that are switched on and switched off with the supply of electricity. The equipment assimilates electricity in order to apply a force and make the movement happen. For instance, the products included in this category can provide the functioning of two main groups of systems: (1) outdoor closures and (2) indoor closures. Examples of the two categories are listed below (not exhaustive list):

1. Exterior applications
- Swing gates: generally, consist of double gates which turn on a hinge for their opening and closure.
  - Sliding gates: generally, consist of a single gate which slide on a track along the fence.
  - Barrier gates: linear systems which can rise or lower to control vehicles access to a specific area.
  - Roller shutter, venetian blinds, awnings and pergolas: generally consist in applications that raise or lower to adjusting the amount of light coming in the building.
2. Interior applications
- Blind and curtain: solid or louvered movable cover for doors or windows.

<sup>3</sup> Some rules influencing EPD development are independent of the GPI version referred to in the PCR. For example, the latest rules on EPD verification procedures in the GPI shall be followed within 90 days of its publication. See Section 5.1 in the GPI for a description of the four categories of rules and when they shall be followed.

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- Garage and industrial doors: usually divided into up-and-over and sectional; they can be open sliding on a track.

This PCR is not compliant with EN 15804 (European construction product standard), because the product category is not associated to a building in all of its applications. If an EPD of a product in the product category intends to comply with EN 15804, PCR 2019:14 Construction products shall be used instead.

This PCR is not compliant with EN 50693 (European electronics product standard). If an EPD of a product in the product category intends to comply with EN 50693, PCR 2024:06 Electronic and electric equipment, and electronic components, shall be used instead.

## 2.2.2 GEOGRAPHICAL SCOPE

This PCR may be used globally.

## 2.2.3 EPD VALIDITY

An EPD becomes valid as of its version date (see Section 8.4.5 of the GPI). When an EPD is originally published, the validity period is normally five years starting from the version date or until the EPD has been de-registered from the International EPD System. Shorter validity periods are also accepted, for example if decided by the EPD owner.

For rules on when an EPD shall be updated and re-verified during its validity, see Section 6.8.1 of the GPI. For validity periods in case of updates of EPDs, see Section 6.8 of the GPI.

The version date and the period of validity shall be stated in the EPD.

Publication of a new version of the PCR or the GPI does not affect the validity of already published EPDs.

### 3 REVIEW AND BACKGROUND INFORMATION

This PCR was developed in accordance with the PCR development process described in the GPI of the International EPD System, including open consultation and review.

#### 3.1 OPEN CONSULTATION

##### 3.1.1 VERSION 1.0.0

This PCR was available for open consultation from 2019-06-03 until 2019-08-03, during which any stakeholder was able to provide comments by posting on the PCR forum on [www.environdec.com](http://www.environdec.com) or by contacting the PCR moderator.

Stakeholders were invited via e-mail or other means to take part in the open consultation and were encouraged to forward the invitation to other relevant stakeholders.

##### 3.1.2 VERSION 2.0.0

This PCR is available for open consultation from 2025-02-10 until 2025-04-10, during which any stakeholder is able to provide comments by contacting the PCR Moderator and/or the Secretariat.

Stakeholders were invited via e-mail or other means to take part in the open consultation and were encouraged to forward the invitation to other relevant stakeholders. The following stakeholders provided comments during the open consultation and agreed to be listed as contributors in the PCR and on [www.environdec.com](http://www.environdec.com):

- Nice Nordics

#### 3.2 PCR REVIEW

##### 3.2.1 VERSION 1.0.0

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PCR review panel:        | The Technical Committee of the International EPD System. A full list of members is available on <a href="http://www.environdec.com">www.environdec.com</a> . The review panel may be contacted via <a href="mailto:support@environdec.com">support@environdec.com</a> .<br><br>Members of the Technical Committee were requested to state any potential conflict of interest with the PCR Committee, and if there were conflicts of interest they were excused from the review. |
| Chair of the PCR review: | Gorka Benito Alonso                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Review dates:            | 2019-08-16 until 2019-09-02                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

##### 3.2.2 VERSION 2.0.0

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PCR review panel:        | The Technical Committee of the International EPD System. A full list of members is available on <a href="http://www.environdec.com">www.environdec.com</a> . The review panel may be contacted via <a href="mailto:support@environdec.com">support@environdec.com</a> .<br><br>Members of the Technical Committee were requested to state any potential conflict of interest with the PCR Committee, and if there were conflicts of interest they were excused from the review. |
| Chair of the PCR review: | Nasser Ayoub                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Review dates:            | 2025-06-02 until 2025-07-18                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

### 3.3 EXISTING PCRS FOR THE PRODUCT CATEGORY

As part of the development of this PCR, existing PCRs and other internationally standardised methods that could potentially act as PCRs were considered to avoid unnecessary overlaps in scope and to ensure harmonisation with established methods of relevance for the product category. The existence of such documents was checked among the following EPD programmes and international standardisation bodies:

- International EPD System. [www.environdec.com](http://www.environdec.com).
- PEP Ecopassport® program. <http://www.pep-ecopassport.org/>
- AENOR Global EPD. <https://www.aenor.com/certificacion/certificacion-de-producto/declaraciones-ambientales-de-producto>
- ASTM International. <https://www.astm.org/>
- Norwegian EPD Foundation. <https://www.epd-norge.no/>
- Institut Bauen und Umwelt (IBU): <https://epd-online.com>

Table 1 lists the identified PCRs and other standardised methods.

*Table 1. Existing PCRs and other internationally standardised methods that were considered to avoid overlap in scope and to ensure harmonisation with established methods.*

| Name of PCR/standard, incl. registration number                                                                                                                        | Programme/standardisation body | Version number/date of publication | Scope                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product specific rules for drives for blinds and closures installed in buildings                                                                                       | PEP Ecopassport®               | PSR-0006- ed2-EN-2023 06 06        | Common basis for manufacturers of drives for blinds and closures installed in buildings, when drafting an LCA.                                                     |
| PCR – Part A “Product Category Rules for Building-Related Products and Services” + Part B “Requirements on the EPD for Drive systems for automatic doors and gates” v5 | IBU                            | Part A, version 2.2                | The PCR considers the Drive systems for automatic doors and gates as building elements (that is linked with EN 15804 standard for Sustainability of construction). |

In all cases Product Specific Rules (PSR) and Product Category Rules (PCR) above mentioned are related to similar product categories (not covering completely all the products considered in this PCR proposal).

Especially in the case of IBU’s PCR, the products covered are considered building elements, which is not the case for the present PCR (the motors could be used in a building or not). Therefore, the present PCR is not only for constructions products and doesn't intend to associate the product to a building in all cases, so this product category is not linked to EN 15804.

In order to harmonize the present PCR with the existing documents displayed in the table, the use stage, previously defined based on the approach described in PSR-0006- ed2-EN-2023 06 06, has been maintained. Further information in Section 4.9.3.

### 3.4 REASONING FOR DEVELOPMENT OF PCR

This PCR was developed to enable publication of EPDs for the product category defined in Section 2.2.1 based on ISO 14025 and ISO 14040/14044. The PCR enables different practitioners to generate consistent results when assessing the environmental impact of products of the same product category, and thereby it supports comparability of products within a product category.

### 3.5 UNDERLYING STUDIES USED FOR PCR DEVELOPMENT

The methodological choices made during the development of this PCR (declared/functional unit, system boundary, allocation methods, impact categories, data quality rules, etc.) were primarily based on the following underlying studies:



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- Barkmeyer, M., Kaluza, A., Pastewski, N., Thiede, S., & Herrmann, C. (2017). Assessment of end-of-life strategies for automation technology components. *Procedia CIRP*, 61, 34-39.
- Olivetti, E., Duan, H., & Kirchain, R., (2013). Exploration of carbon footprint of electrical products: guidance document for product attribute to impact algorithm methodology. A publication of the Materials Systems Laboratory, Massachusetts Institute of Technology, Cambridge.
- Nice SpA, Life Cycle Assessment Assessment dei prodotti Nice per l'automazione - motoriduttori. Study conducted by Ambiente Italia srl (the document is intended for internal use and has not been published).
- Louis, J. N., Calo, A., Leiviskä, K., & Pongrácz, E. (2015). Environmental impacts and benefits of smart home automation: Life cycle assessment of home energy management system. *IFAC-PapersOnLine*, 48(1), 880-885.
- Walzberg, J., Dandres, T., Merveille, N., Cheriet, M., & Samson, R. (2019). Assessing behavioural change with agent-based life cycle assessment: application to smart homes. *Renewable and Sustainable Energy Reviews*, 111, 365-376.

## 4 LCA METHOD

This section provides rules for the LCA method used to develop an EPD for the product category as defined in Section 2.2.1. The basic rules of the LCA method are set in Annex A of the GPI, and this section only includes additions, specifications and deviations to the rules set in the GPI. Guidance and examples of applying the LCA method are also available on [www.environdec.com/methodology](http://www.environdec.com/methodology).

### 4.1 MODELLING APPROACH

See Section A.1 of the GPI.

### 4.2 FUNCTIONAL UNIT

The functional unit of the product shall be a drive capable of assuring a rated output equal to 10 W for the movement of an object during its Reference Service Life (RSL). If the product has a proven rated output higher or lower than 10 W, then the environmental impacts must be calculated accordingly (i. e., if the product has an output of 50 W, it means that all the LCIA results shall be divided by 5. On the other hand, if the product has an output of 1 W, it means that all LCIA results shall be multiplied by 10).

The rated output (or nominal power) shall be calculated as follow:

- For a gear motor that performs a linear movement:

$$P_n = F \cdot v_n$$

Where:

$P_n$  = nominal power [W]

$F$  = nominal force [N]

$v_n$  = nominal velocity [m/s]

- For a gear motor that performs an angular movement:

$$P_n = M \cdot \omega_n \quad \text{with} \quad \omega_n = n \cdot \left(\frac{2\pi}{60}\right)$$

Where:

$P_n$  = nominal power [W]

$M$  = nominal torque [Nm]

$\omega_n$  = nominal angular velocity [rad/s]

60 = seconds in one minute

$n$  = number of rounds per minute [rpm]

In addition, the following conditions must be satisfied:

- Force, torque, velocity and angular velocity are those declared in the motor nameplate, and they are referred to nominal work conditions.
- The velocity/angular velocity is the one which is detected at the nominal force/torque, i.e. measured in the period in which the application moves with a constant velocity – therefore excluding transitory phases of acceleration or deceleration.

All the automation systems to which the PCR refers, are moved by the same product, i.e. a gear motor, hence the same functional unit may be applied to every product in this category.

The functional unit shall be stated in the EPD, including the detail of every value used in the equations given in Section 4.2. The environmental impact shall be given per functional unit. A text description of the function of the product should be included in the EPD, if relevant.

Table 2. Example for the functional unit declaration in the EPD.

| Technical information   | Unit         | Value |
|-------------------------|--------------|-------|
| Nominal force or torque | N or Nm      |       |
| Nominal velocity        | m/s or rad/s |       |

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#### 4.2.1 TECHNICAL SPECIFICATION AND REFERENCE SERVICE LIFE (RSL)

As a requirement of the GPI, the technical specification shall include sufficient information for a user of the EPD to assess the technical performance and usefulness of a product in each relevant context.

Section A.2.1 of the GPI provide more information on the definitions of lifespan and RSL. The reference service life (RSL) is defined as 10 years. The RSL shall be declared in the EPD. The concept is further addressed in Section 4.9.3.

### 4.3 SYSTEM BOUNDARY

The scope of this PCR and EPDs based on it is cradle-to-grave. Given the importance of the use stage, deviations from a “cradle to grave” system boundary are not allowed for this product category.

#### 4.3.1 LIFE-CYCLE STAGES AND INFORMATION MODULES

Because of different data quality rules and the presentation of results, the product life cycle shall be divided into the following life-cycle stages and information modules:

- Product stage, modules A1-A3:
  - A1: Raw material extraction and processing (e.g., mining, agricultural and forestry operations), production of intermediate materials and components (e.g., including transformation processes such as rolling, drawing and extrusion), processing of secondary material input (e.g., recycling processes), production of distribution and consumer packaging, etc.
  - A2: Transports to the manufacturer of the product
  - A3: Manufacturing of the product<sup>4</sup>
- Distribution and installation stage, modules A4-A5:
  - A4: Transport of the product to the building/installation site/user, including storage of product (e.g., warehouse and retail operations)
  - A5: Installation of the product, includes transports and waste processing of material and product losses (see section 4.3.12 of this PCR for further information)
- Use stage, modules B1-B7:
  - B1: Use of the product (e.g., including direct emissions associated with its use)
  - B2: Maintenance of the product
  - B3: Repair of the product
  - B4: Replacement
  - B5: Refurbishment
  - B6: Energy use during the RSL
  - B7: Water use during the RSL
- End-of-life stage, modules C1-C4:
  - C1: Deinstallation
  - C2: Transport to waste processing and/or disposal
  - C3: Waste processing for reuse, recovery and/or recycling
  - C4: Disposal

In addition, consequences of recovered material/energy beyond the product cycle shall be reported in module D.

In the EPD, the environmental performance of each of the life-cycle stages and module D shall be reported separately, and in aggregated form for the life-cycle stages (modules A-C).

<sup>4</sup> These are often, but not always, the processes under operational control of the EPD owner.

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Section A.3.1 of the GPI outlines rules for how to assign generation of electricity and production of fuels, steam and other energy carriers used, and losses arising, in each information module.

The following sections further describe the processes to include or exclude for each life-cycle stage.

## 4.3.1.1 Modules A1-A3: Product stage

- **Module A1:**
  - Extraction and production of raw material for all main parts and components and its packaging. Main components and all the materials used for the manufacturing of main components shall be characterised. In particular, all the electronic components of the printed circuit boards shall be identified, including the transport distance between the manufacturer and the assembly facility.
  - Impacts due to the production of electricity and fuels used in the A1 module.
  - Production of auxiliary products used such as detergents for cleaning, grease for lubrication, etc.
  - Production of semi products used in the core process, if applicable.
  - Manufacturing of primary, secondary and tertiary packaging.
- **Module A2:**
  - External transportation to the core processes
- **Module A3:**
  - Assembly/preparation phase of the product unit
  - Internal transportation within the factory
  - Waste treatment of waste generated during manufacturing/assembly
  - Impacts due to the production of electricity and fuels used in the core module
  - Production and treatment of the material losses that occur in Module A3, if relevant
  - Every transportation between the organization and possible subcontractors which develop part of the core work.

Processes not listed here may also be included. All elementary flows at resource extraction shall be included, except for the flows that fall under the general cut-off rule in Section 4.5.

## 4.3.1.2 Modules A4-A5: Distribution and installation stage

- **Module A4:**
  - Transportation from preparation to an average retailer/distribution platform
- **Module A5:**
  - Transportation from the retailer/distribution platform to the installation site (see section 4.9.2)
  - End-of-life processes of packaging waste

Processes not listed here may also be included. All elementary flows at resource extraction shall be included, except for the flows that fall under the general cut-off rule in Section 4.5.

## 4.3.1.3 Modules B1-B7: Use stage

- **Module B1:** Not applicable.
- **Module B2:**
  - Production of lubricants used in maintenance, during the RSL of the product, if relevant (most of the products in the PCR scope do not need maintenance)
- **Module B3:**
  - Production of substitution parts for the repair of the product, during the RSL, including the end-of-life of substituted items

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- Transport from the retailer to the installation site for repairing operations
- Module B4:
  - Production of the number of items that will be replaced with the broken one, during the RSL, including the end-of-life of substituted items
  - Transport from the retailer to the installation site for replacement operations
- Module B5: Not applicable.
- Module B6:
  - Electric energy use during the use of the product, including energy losses for distribution and transformation (see section 4.9.3)
- Module B7: Not applicable.

Processes not listed here may also be included. All elementary flows at resource extraction shall be included, except for the flows that fall under the general cut-off rule in Section 4.5.

## 4.3.1.4 Modules C1-C4: End-of-life stage

- Module C1:
  - Initial on-site sorting of the materials, before deinstallation
  - Deinstallation operations
- Module C2:
  - Transportation of the discarded product to the waste processing/disposal facility
- Module C3:
  - Processing of waste fractions, such as sorting and pressing
  - Waste processing of material flows intended for reuse, recycling and energy recovery
- Module C4:
  - Production of materials and energy for waste disposal, including physical pre-treatment and management of the disposal site

Processes not listed here may also be included. All elementary flows at resource extraction shall be included, except for the flows that fall under the general cut-off rule in Section 4.5.

## 4.3.1.5 Excluded processes

See Section A.3.1.1 of the GPI.

## 4.3.2 OTHER BOUNDARY SETTING RULES

See Section A.3.2 of the GPI for rules on setting boundaries to nature as well as geographical and temporal boundaries. See Section A.4 of the GPI and Section 4.6 below for rules on setting boundaries to other product systems.



## 4.4 PROCESS FLOW DIAGRAM



Figure 2. Process flow diagram illustrating the processes that shall be included in the product system, divided into the life-cycle stages. The illustration of processes to include may not be exhaustive.

## 4.5 CUT-OFF RULES

See Section A.3.3 of the GPI.

## 4.6 ALLOCATION RULES

See Section A.4 of the GPI.

### 4.6.1 ALLOCATION OF CO-PRODUCTS

There are no co-products identified for the key processes in the product system. For general requirements, see Section A.4.1 of the GPI.

### 4.6.2 ALLOCATION OF WASTE

See Section A.4.2 of the GPI.

## 4.7 DATA AND DATA QUALITY RULES

See Section A.5 of the GPI.

See Section 4.8 for further rules related to data and data quality per life-cycle stage and module D.

### 4.7.1 DATA CATEGORIES

See Section A.5.1 of the GPI.

### 4.7.2 DATA QUALITY REQUIREMENTS FOR PRIMARY DATA

See Section A.5.2 of the GPI. In addition, if the product is manufactured in facilities that are not under the EPD owner's control, primary data must be preferred. If it is not possible to acquire the information at a reasonable cost, secondary data shall be used (if they fulfil the requirements in section 4.7.3).

#### 4.7.3 DATA QUALITY REQUIREMENTS FOR REPRESENTATIVE SECONDARY DATA

See Section A.5.3 of the GPI.

#### 4.7.4 DATA QUALITY ASSESSMENT AND DECLARATION

See Section A.5.4 of the GPI.

### 4.8 OTHER LCA RULES

See Section A.6 of the GPI.

For specific LCA rules per life-cycle stage, see Section 4.9.

#### 4.8.1 MASS BALANCE

See Section A.6.1 of the GPI.

#### 4.8.2 ELECTRICITY MODELLING

See Section A.6.2 of the GPI.

#### 4.8.3 BIOGAS MODELLING

See Section A.6.3 of the GPI.

### 4.9 SPECIFIC RULES PER LIFE-CYCLE STAGE AND MODULE D

See Section A.7 of the GPI.

Below are further data quality requirements and other LCA rules per life-cycle stage, and for module D, of relevance for the product category.

#### 4.9.1 PRODUCT STAGE, A1-A3

This PCR does not provide any additions to the rules and guidance in the GPI on the modelling of the product stage.

#### 4.9.2 DISTRIBUTION AND INSTALLATION STAGE, MODULES A4-A5

Logistic information from the retailer to the installation site is difficult to assess for the life cycle analysis, as the means of transport are selected on a case-by-case basis depending on the configuration of the installation site. If the actual scenario cannot be assessed, as the EPD owner does not have enough control on this information, the transportation shall be set to 50 km (typical maximum distance from retailer to installation site), selecting the type of road transport based on a reasonable scenario.

Masonry work for installation consists in a standard manual operation with a negligible environmental impact. All construction activities are excluded because they are carried out according to the building and/or its perimeter (fence); these are therefore highly variable from case to case and transcend the application of the products in the scope of this PCR.

#### 4.9.3 USE STAGE, MODULES B1-B7

Data for the use stage are usually based on scenarios, but specific data should be used when available and relevant. Based on the technical information regarding the product, energy consumption in the use phase (B6) shall be calculated as follow:

$$\text{Consumption for 1 year [kWh/y]} = \left[ \left( \frac{P_m}{1000} \times t_m \times 24h \right) + \left( \frac{P_s}{1000} \times t_s \times 24h \right) \right] \times 365$$

Where:

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 $P_m$  = electric power assimilated in the motion phase [W] $t_m$  = motion ratio $P_s$  = electric power assimilated in the stand-by phase [W] $t_s$  = stand-by ratio

Consumption during the **standby phase** is measured in compliance with the test conditions defined by the international standard IEC 62301: *Household electrical appliances - Measurement of standby power*.

It must be underlined that the actual conditions of use of automatics are difficult to define because the building elements do not have standards dimensions and because the types and requirements for use phase are highly variable. The following rules shall be followed to calculate the statistical average energy consumption of an automation motor (**motion phase**): real power, in motion (average value) can be reasonably estimated considering that these products work at 75% of the nominal torque.

$$P_m = NLP + 0,75 \times (NP - NLP)$$

Where:

NLP = No-load power [W]

NP = Nominal power [W]

The following rules shall be followed in order to establish the technical specifications of an automation motor:

- Prior to testing, the motor must be inspected and assessed as working correctly. Before testing, the motors should be 'run in' for at least 100 complete cycles under a nominal load.
- All measurements should be carried out at the nominal supply voltage and at a temperature of between 20° and 25°C, in order to avoid that the effects of motor heating affect the tests.
- Specific rules for **nominal power** (at nominal force): The absorbed power during normal operation. This is the characteristic value defined by the regulations, related to the nominal torque used to define the real operating force of a device. Test method: if there is an adjustable gear speed, it must be set to maximum; the motor is loaded at the nominal torque (both motors for 2-door systems). The power is measured in the middle of the cycle; after the acceleration stage and before the deceleration stage.
- Specific rules for **no-load power** (without any load): power due only to internal friction. This data is not declared and serves only for calculating average power. Test method: The motor is placed in a condition to run normally, unblocked, free and without load (e.g. barrier without rod and without springs). The power is measured in the middle of the cycle, after acceleration and before deceleration.
- In all of the above measurements, the measurement shall be made in both directions, taking the greater value.
- For each type of measurement this must be repeated 3 times and is considered valid if the minimum and maximum measurements are within a range of 5% from the average value. The figure to be taken as reference is the average value.
- Specific cases:
  - For complete, mains-powered systems (built-in power station): measurements are to be made directly on the mains.
  - For systems comprising several motors with a separate control unit:
    - a) both the measurement on the mains (overall power) and the measurement of the powers on the lines going to the motors (individual motor power) shall be carried out.
    - b) the values of the individual external motor are those measured on its line.
    - c) the values of the power station are equal to the overall measurement by subtracting the values of the motors (or single motor). This subdivision by subtraction makes it possible to assign the motors their own specific value (independent of the power station's output) and to assign to the power station both its own internal consumption and the output to produce the energy required by the motors.

Motion ratio is a measure of the period the gear motor spends applying a force/torque to move an object, i. e. an automation system. It shall be calculated as:

$$t_m = \frac{T \times C}{3600 \times 24}$$

Where:

T = time for performing one operating cycle [seconds]

C = number of cycles per day [number]

Stand-by ratio shall be therefore calculated as:

$$t_s = 1 - t_m$$

The presented formula refers to the electricity that the product consumes in one year; the complete use phase shall be therefore calculated for the reference service life. The product, if used properly by the consumer, granted a specific number of operating cycles, defined as the complete operation of opening and closing; based on the value of total operating cycles and the operating cycles granted in one year. For the present product category, RSL is equal to 10 years. Following the rules of the GPI, the Reference service life (RSL) and its relationship with the actual lifespan, if different, shall be declared in the LCA Report and in the EPD. Hence, the use phase shall be finally calculated as reported below:

$$\text{Consumption (kWh)} = \left[ \left( \frac{P_m}{1000} \times t_m \times 24h \right) + \left( \frac{P_s}{1000} \times t_s \times 24h \right) \right] \times 365 \times RSL$$

The use of electricity in the region/country where the product is used (as specified in the geographical scope of the EPD) shall be accounted. The assumption is that the use of the product will correspond to the geographical site in which the manufacturer has sold it; hence, the reference to the region/country shall be the one indicated in the distribution scenario (from the manufacturer to the retailer/distribution platform).

Every component of the automation system that contributes to the complete functioning of the product shall be included in the Life Cycle Assessment, especially when these items are directly connected with the use phase (e. g., control units).

#### 4.9.4 END-OF-LIFE STAGE, MODULES C1-C4

This PCR does not provide any additions to the rules and guidance in the GPI on the modelling of the end-of-life stage.

#### 4.9.5 CONSEQUENCES FOR RECOVERED MATERIAL/ENERGY BEYOND THE PRODUCT LIFE CYCLE (MODULE D)

This PCR does not provide any additions to the rules and guidance in the GPI on the modelling of module D.

### 4.10 ENVIRONMENTAL PERFORMANCE INDICATORS

See Section A.8 of the GPI.

### 4.11 SPECIFIC RULES PER EPD TYPE

#### 4.11.1 MULTIPLE PRODUCTS FROM THE SAME COMPANY

See Section A.9.1 of the GPI.

#### 4.11.2 SECTOR EPD

See Section A.9.2 of the GPI.

#### 4.11.3 EPD OWNED BY A TRADER

See Section A.9.3 of the GPI.

#### 4.11.4 EPD OF PRODUCT NOT YET ON THE MARKET

See Section A.9.4 of the GPI.

#### 4.11.5 EPD OF PRODUCT RECENTLY ON THE MARKET

See Section A.9.5 of the GPI.

## 5 CONTENT OF LCA REPORT

Data for verification shall be presented in the form of an LCA report – a systematic and comprehensive summary of the project documentation that supports the verification of an EPD. The LCA report is not part of the public communication.

See Section 8.3.1 of the GPI for rules on the content of the LCA report.

Note that there may be rules on the content of the LCA report elsewhere in the GPI or in this PCR.

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## 6 CONTENT AND FORMAT OF EPD

See Section 7 of the GPI.

### 6.1 EPD LANGUAGES

See Section 7.1 of the GPI.

### 6.2 UNITS AND QUANTITIES

See Section 7.2 of the GPI.

### 6.3 USE OF IMAGES IN EPD

See Section 7.3 of the GPI.

### 6.4 SECTIONS OF THE EPD

See Section 7.4 of the GPI.

#### 6.4.1 COVER PAGE

See Section 7.4.1 of the GPI.

#### 6.4.2 GENERAL INFORMATION

See Section 7.4.2 of the GPI.

#### 6.4.3 INFORMATION ABOUT EPD OWNER

See Section 7.4.3 of the GPI.

#### 6.4.4 PRODUCT INFORMATION

See Section 7.4.4 of the GPI.

#### 6.4.5 CONTENT DECLARATION

See Section 7.4.5 of the GPI.

Table 3. List of the minimum content declaration in the EPD. The list of each specific material here is explanatory, and it shall be defined based on the product analysed. Beyond 5 material groups, other materials shall be listed as one separated category named "Miscellaneous".

| MATERIAL GROUP         | TYPE OF MATERIAL                      | WEIGHT | QUANTITY |
|------------------------|---------------------------------------|--------|----------|
| METALS                 | Steel                                 | kg     | %        |
|                        | Aluminium                             | kg     | %        |
|                        | etc.                                  | kg     | %        |
| PLASTICS               | Polyamide (PA)                        | kg     | %        |
|                        | Acrylonitrile Butadiene Styrene (ABS) | kg     | %        |
|                        | etc.                                  | kg     | %        |
| CABLES AND CONNECTORS  |                                       | kg     | %        |
| PRINTED CIRCUIT BOARDS |                                       | kg     | %        |
| OTHERS                 |                                       | kg     | %        |

The category “others” can contain labels, ink, lubricants, etc. that remain inside the finished product.

## 6.4.6 LCA INFORMATION

See Section 7.4.6 of the GPI.

## 6.4.7 ENVIRONMENTAL PERFORMANCE

See Section 7.4.7 of the GPI.

The EPD shall declare the environmental performance indicators listed or referred to in Section 4.10, per functional unit, per life-cycle stage and module D.

## 6.4.8 ADDITIONAL ENVIRONMENTAL INFORMATION

See Section 7.4.8 of the GPI.

## 6.4.9 ADDITIONAL SOCIAL AND ECONOMIC INFORMATION

See Section 7.4.9 of the GPI.

## 6.4.10 INFORMATION RELATED TO SECTOR EPDS

See Section 7.4.10 of the GPI.

## 6.4.11 VERSION HISTORY

See Section 7.4.11 of the GPI.

## 6.4.12 ABBREVIATIONS

See Section 7.4.12 of the GPI.

## 6.4.13 REFERENCES

See Section 7.4.13 of the GPI.



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## 7 LIST OF ABBREVIATIONS

|     |                                                |
|-----|------------------------------------------------|
| CPC | Central product classification                 |
| EPD | Environmental product declaration              |
| GPI | General Programme Instructions                 |
| ISO | International Organization for Standardization |
| LCA | Life cycle assessment                          |
| PCR | Product category rules                         |
| RSL | Reference service life                         |
| UN  | United Nations                                 |

## 8 REFERENCES

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ISO (2006c) ISO 14044: 2006, Environmental management – Life cycle assessment – Requirements and guidelines.

ISO (2015a) ISO 14001:2015, Environmental management systems – Requirements with guidance for use.

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## 9 VERSION HISTORY OF PCR

### VERSION 1.0, 2019-10-02

Original version of PCR published.

### VERSION 1.01, 2019-10-14

Cover image added.

### VERSION 1.02, 2019-12-03

Erroneous equations in Section 4.1 (page 8) and Section 4.10.3 (page 14) have been corrected.

### VERSION 1.0.3, 2023-07-06

- Change of PCR Moderators.
- Prolonged validity period with 1 year, until 2024-10-02, due to the initiation of an updating process (to update the PCR to version 2.0.0 and prolong its validity with another 4 years).
- Editorial changes, including changes in Sections 5.4.5.1 to 5.4.5.3, to clarify the indicator list at [www.environdec.com](http://www.environdec.com) applies also for the indicators of resource use, waste production and other output flows.

### VERSION 1.0.4, 2024-08-05

- Change of one of the PCR Moderators.
- Prolonged validity period with another 6 months, until 2025-04-02, as the updating process has been delayed while awaiting version 5.0.1 of the GPI.

### VERSION 2.0.0, 2025-10-20

- Alignment of the PCR to a new version of the GPI (version 5.0.1).
- Further specification on how to define technical specifications for the Use Phase calculations.
- Additional requirements for Content Declaration added.

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