PRODUCT CATEGORY RULES (PCR)
DATE 2023-05-04

BEARINGS, BEARING UNITS AND PARTS THEREOF

PRODUCT CATEGORY CLASSIFICATION: UN CPC 4331, 4332 (SUBSET), 4333 (SUBSET)

PCR 2023:03
VERSION 1.0.0

VALID UNTIL 2027-05-04

TABLE OF CONTENTS

1 INTRODUCTION

This document constitutes Product Category Rules (PCR) developed in the framework of the International EPD® System: a programme for type III environmental declarations[1] 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. Environmental Product Declarations (EPD) are voluntary documents for a company or organisation to present transparent, consistent and verifiable information about the environmental performance of their products (goods or services).

The rules for the overall administration and operation of the programme are the General Programme Instructions (GPI), publicly available at www.environdec.com. A PCR complements the GPI and the normative standards by providing specific rules, requirements and guidelines for developing an EPD for one or more specific product categories (see Figure 1). A PCR should enable different practitioners using the PCR to generate consistent results when assessing products of the same product category.

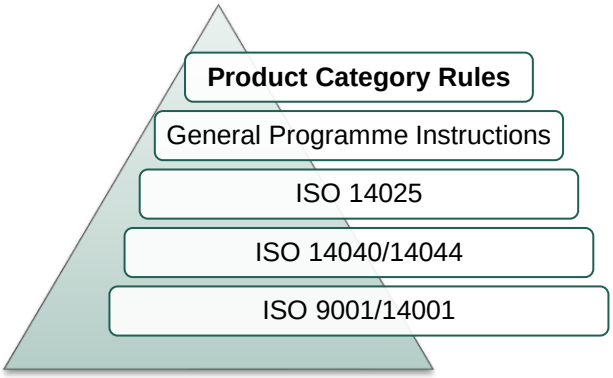


Figure 1 The hierarchy between PCRs, standards and other documents.

Within the present PCR, the following terminology is adopted:

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

For definitions of further terms used in the document, see the normative standards.

A PCR is valid for a pre-determined period of time to ensure that it is updated at regular intervals. The latest version of the PCR is available at www.environdec.com. 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.

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

The programme operator maintains the copyright of the document 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.

[1] Type III environmental declarations in the International EPD® System are referred to as EPDs, Environmental Product Declarations.

2 GENERAL INFORMATION

2.1 ADMINISTRATIVE INFORMATION

Name:	Bearings, bearing units and parts thereof
Registration number and version:	2023:03, version 1.0.0
Programme:	The International EPD® System
Programme operator:	EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden. Website: www.environdec.com E-mail: info@environdec.com
PCR Moderator:	Yanjing ZHU, IVL Swedish Environmental Research Institute, yanjing.zhu@ivl.se
PCR Committee:	AB SKF IVL Swedish Environmental Research Institute
Date of publication and last revision:	2023-05-04 (Version 1.0.0)
Valid until:	2027-05-04
Schedule for renewal:	A 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 how to proceed with updating the PCR and renewing its validity. A PCR may also be updated without prolonging its period of validity, provided significant and well-justified proposals for changes or amendments are presented. See www.environdec.com for the latest version of the PCR. When there has been an update of the PCR, the new version should be used to develop EPDs. The old version may however be used for 90 days after the publication date of the new version, as long as the old version has not expired.
Standards conformance:	General Programme Instructions of the International EPD® System, version 4.0, based on ISO 14025 and ISO 14040/14044
PCR language(s):	At the time of publication, this PCR was available in English. If the PCR is available in several languages, these are available at www.environdec.com. In case of translated versions, the English version takes precedence in case of any discrepancies.

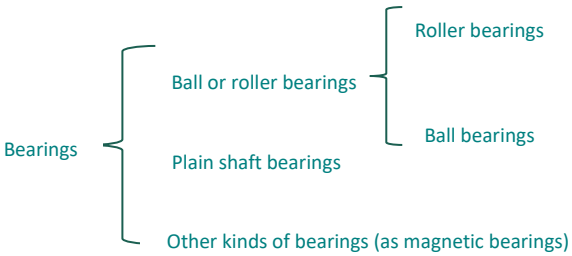
2.2 SCOPE OF PCR

2.2.1 PRODUCT CATEGORY DEFINITION AND DESCRIPTION

This document provides Product Category Rules (PCR) for the assessment of the environmental performance of bearings, bearing units and parts thereof and the declaration of this performance by an EPD. The product category corresponds to UN CPC 4331 (Ball or roller bearings), a subset of UN CPC 4332 (Transmission shafts and cranks; bearing housings and plain shaft bearings; gears and gearing; ball or roller screws, gear boxes and other speed changers; flywheels and pulleys; clutches and shaft couplings; articulated link chain), and a subset of UN CPC 4333 (Parts for the goods of classes 4331 and 4332). The subset of UN CPC 4332 covered is bearing housings and plain shaft bearings, and the subset of UN CPC 4333 covered are parts for the goods of classes 4331 and 4332 that are included in the scope, as described in the following:

- Division: 43 – General-purpose machinery
  - Group: 433 - Bearings, gears, gearing and driving elements, and parts thereof
    - Class: 4331 - Ball or roller bearings (this PCR)
    - Class: 4332 - Bearing housings and plain shaft bearings (this PCR)
    - Class: 4333 - Parts for the goods of classes 4331 and 4332 (this PCR)

More information about the UN CPC classification is available at https://unstats.un.org/unsd/classifications/Family/Detail/1074.



Ball or roller bearings belong to rolling bearings. Rolling bearings support and guide, with minimal friction, rotating or oscillating machine elements – such as shafts, axles or wheels – and transfer loads between machine components. Rolling bearings provide high precision and low friction and therefore enable high rotational speeds while reducing noise, heat, energy consumption and wear. A typical rolling bearing consists of the following components:

- An inner ring
- An outer ring
- Balls or rollers, as rolling elements
- A cage

The two basic types of rolling element distinguish the two basic types of rolling bearing:

- Ball → ball bearing
- Roller → roller bearing

Balls and rollers are different in how they make contact with the raceways:

- Balls make point contact with the ring raceways. With increasing load acting on the bearing, the contact point becomes an elliptical area. The small contact area provides low rolling friction, which enables ball bearings to accommodate high speeds but also limits their load-carrying capacity.
- Rollers make line contact with the ring raceways. With increasing load acting on the bearing, the contact line becomes somewhat rectangular in shape. Because of the larger contact area and the consequently higher friction, a roller bearing can accommodate heavier loads, but lower speeds, than a same-sized ball bearing.

Bearing housings: a bearing housing is to

- Support the bearing and transmit operating static and dynamic loads

- Protect the bearing and lubricant from contaminants
- Contain the lubricant and accommodate lubrication system components
- Accommodate monitoring system components
- Maximize the performance and service life of the incorporated bearings

Bearing housings are typically made of grey cast iron or spheroidal graphite cast iron, typical types of bearing housings include split plummer (pillow) block housing, non-split plummer (pillow) block housing, flanged housing, take-up housing, two-bearing housing, and specific housings which have features that enable them to be used in special operating conditions, etc.

Plain shaft bearings: plain bearings are composed of two parts. There is the fixed part, which bears the loads, known as the support; and the area that gets worn, i.e., that is in contact with the moving element, the bush. With the purpose of minimizing the losses generated by the bearing friction, material pairs with low friction coefficient are generally used, or a lubricant is added between the parts.

Plain bearings can be manufactured from a variety of materials, including metal-polymers, engineered plastics, fibre-reinforced composite and metals that reduce noise, increase service life, eliminate lubricants and improve efficiency, etc.

Bearing units are also included in this PCR. For example, roller bearing units consist of a bearing, housing, lubricant (which has been added into the units as a whole product before sell to the customer) and seals as well as a mechanism to lock the bearing inner ring onto the shaft. These ready-to-mount units are assembled, lubricated and sealed at the factory for maximum service life. Bearing units require less maintenance, they are also easy to install and replace.

2.2.2 GEOGRAPHICAL SCOPE

This PCR may be used globally.

2.2.3 EPD VALIDITY

An EPD based on this PCR shall be valid for a 5-year period starting from the date of the verification report (“approval date”), or until the EPD has been de-registered from the International EPD® System.

An EPD shall be updated and re-verified during its validity if changes in technology or other circumstances have led to:

- An increase of 10% or more of any of the declared indicators of environmental impact,
- Errors in the declared information, or
- Significant changes to the declared product information, content declaration, or additional environmental, social or economic information.

If such changes have occurred, but the EPD is not updated, the EPD owner shall contact the Secretariat to de-register the EPD.

3 PCR 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 is available for open consultation from 2022-05-05 until 2022-07-04, during which any stakeholder was 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 at www.environdec.com:

- Vasilios Bakola, Schaeffler Technologies AG & Co. KG
- Yanli Wang, Xinjiang Goldwind Science and Technology Co. Ltd
- Dirk Holweger, Siemens-Puc Bearings

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 at www.environdec.com. The review panel may be contacted via info@environdec.com. 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:	2022-12-06 until 2023-02-16

3.3 EXISTING PCRS FOR THE PRODUCT CATEGORY

As part of the development of this PCR, existing PCRs and other internationally standardized 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
- EPD Norge. https://www.epd-norge.no/
- IBU. https://ibu-epd.com/
- EPD Italy. https://www.epditaly.it/view-pcr/
- PEP Ecopassport. http://www.pep-ecopassport.org/
- Product Environmental Footprint (PEF). www.ec.europa.eu/environment/eussd/smgp

Table 1 lists the identified PCRs and other standardized methods.

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

NAME OF PCR/STANDARD	PROGRAMME/ STANDARDISATION BODY	REGISTRATION NUMBER, VERSION NUMBER/DATE OF PUBLICATION	SCOPE
PCR 2014:10 Fabricated steel products, except construction products, machinery and equipment	International EPD® System	2014:10 VERSION 2.12 VALID UNTIL: 2022-10-04 PUBLICATION DATE: 2019-09-06	No overlap in scope. Rules for developing EPDs for finished steel products (non-construction)
PCR 2015:03 Basic iron or steel products & special steels, except construction steel products	International EPD® System	2015:03 VERSION 2.0 VALID UNTIL: 2024-03-27 PUBLICATION DATE: 2020-03-27	No overlap in scope. Rules for developing EPDs for basic steel and iron products (non-construction)
PCR 2008:01 Ball or roller bearings	International EPD® System	Expired PCR	The expired PCR is only applicable to Bearing Rolling Elements, not the bearings and bearing units. The “parts thereof” in the scope pf the present PCR includes the Bearing Rolling Elements.
NPCR 013 Part B for steel and aluminium construction products (references to EN15804+A2)	EPD NORGE	NPCR 013 VERSION 4.0 VALID UNTIL: 2024-04-10 PUBLICATION DATE: 2021-10-6	No overlap in scope. Rules for developing EPDs for finished steel and aluminium products (construction)
NPCR 013 Part B for steel and aluminium construction products	EPD NORGE	NPCR 013 VERSION 3.0 VALID UNTIL: 2024-04-10 PUBLICATION DATE: 2019-04-10	No overlap in scope. Rules for developing EPDs for finished steel and aluminium products (construction)
PEFCR 2019-06-28 for Metal Sheets for Various Applications	European Commission	PEFCR 2019-06-28 Expired on Dec 31, 2021.	No overlap in scope. Rules for developing PEFs for metal sheets (construction and non-construction)

No valid PCRs or other relevant internationally standardized methods with overlapping scope were identified

3.4 REASONING FOR DEVELOPMENT OF PCR

This PCR was developed to enable publication of EPDs for this product category based on ISO 14025, 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:

- Ekdahl, Å., 2007. Report 2001:1, Life Cycle Assessment on SKF's Spherical Roller Bearing. 24024, Chalmers University of Technology.
- Rinde, B, 2008. LCA and Methodological Choices for Identification of Improvement Potential - Case Study Bearing Unit, Chalmers University of Technology.
- Agestam, K, 2011. Comparison of sealed and open roller bearings using an environmental life cycle perspective-study including a life cycle assessment for a specific application and development of a life cycle based tool.
- Ranjan, P, Agrawal, R, and Jain, JK, 2019, Life Cycle Assessment of Needle Roller Bearing, Proceedings of the International Conference on Industrial Engineering and Operation Management Pilsen, Czec Republic, July 23-26, 2019.

4 GOAL AND SCOPE, LIFE CYCLE INVENTORY AND LIFE CYCLE IMPACT ASSESSMENT

The goal of this section is to provide specific rules, requirements and guidelines for developing an EPD for the product category as defined in Section 2.2.1.

4.1 DECLARED/FUNCTIONAL UNIT

EPDs based on this PCR can use a declared unit or a functional unit.

If a declared unit is used, it shall be defined as one unit of product[2]. The reference flow is defined as one unit of product (in its packaging) leaving the factory gate. This option shall be used when the final application/product is unknown.

If a functional unit is used, it shall be defined as one unit of product[3] used in a specific final product during a reference service life (RSL) depending on the final product (see Section 4.2.2). The reference flow is defined as one unit of product (in its packaging) leaving the factory gate. This option should be used when the final application/product is known.

The choice of declared or functional unit influences the system boundaries, see Section 4.3.1.

To increase comparability between EPDs, the properties of relevance for the application/use of the product shall be declared, when known. This includes the technical properties listed in Section 4.2 as well as a description of the intended use of the bearing (e.g., bearings used for wind turbine, car, etc.).

4.2 TECHNICAL SPECIFICATION, LIFESPAN AND REFERENCE SERVICE LIFE (RSL)

4.2.1 TECHNICAL SPECIFICATION

Table 2 lists technical properties of the product that shall be declared, if relevant and known.

Table 2 Technical properties that shall be declared for the product, if relevant and known.

Bearing bore diameter (mm), for ball and roller bearing	Weight (kg)
Width (mm)	Rotary speed (rpm), for ball and roller bearing
Equivalent Load (N)	Friction torque (Nmm)
Power Loss (W), declared along the specific operating conditions	Designed lifespan of the product (in years). If the lifespan depends on the final application/product, and several applications/products are possible, several lifespans may be declared. If a functional unit is used: Reference service life (RSL) of the final product (in years). See Section 4.2.2.

4.2.2 REFERENCE SERVICE LIFE (RSL) AND LIFESPAN

The reference service life (RSL) shall be described if a functional unit is used. RSL of a product category is the reference time to which the performance of all products of a product category shall be related. The RSL shall be set as expected lifetime at nominal operational conditions, see Tables 3 to 5.

[2] One unit of product may be a bearing, a bearing unit or a part thereof, based on Section 2.2.11.

[3] One unit of product may be a bearing, a bearing unit or a part thereof, based on Section 2.2.11.

Table 3 RSL for final products of relevance for ball and roller bearings, for some industrial sectors.

Wind power (onshore)	20 years
Wind power (offshore)	25 years
Metallurgy	7 years
Automotives and electric vehicles	15 years
Railway	15 years
Others (general industry, material handling, etc)	10 years

Table 4 RSL for final products of relevance for plain bearings, for some industrial sectors.

Wind power (onshore)	20 years
Wind power (offshore)	25 years
Metallurgy	15 years
Heavy industry	5 years
Railway	2 years
Others (general industry, material handling, etc)	10 years

Table 5 RSL for final products of relevance for magnetic bearings, for some industrial sectors.

Power generation	20 years
Turbocompressors	20 years
Machine tool	20 years
high-speed electric machine	20 years

The designed lifespan of the product along the specific operation conditions (lifespan in years, industry used in and application scenarios) shall also be declared in EPD if a functional unit is used and the entire downstream stage is included in the system boundary.

The designed lifespan is not necessarily the same as the RSL, meaning that the bearing, bearing unit or the part thereof can be replaced during the RSL or that less than one product is needed to fulfil the functional unit.

The lifespan of **ball and roller bearing** should be based on ISO 281. For many years, the use of the basic rating life L_{10} as a criterion of bearing performance has proved satisfactory. This life is associated with 90% reliability, with commonly used high quality material, good manufacturing quality, and with conventional operating conditions.

For the radical ball bearing, basic rating life should be calculated as:

$$L_{10} = \left(\frac{Cr}{Pr}\right)^3$$

Cr: load rating, in newtons

Pr: equivalent load, in newtons

For the thrust ball bearing, basic rating life should be calculated as:

$$L_{10} = \left(\frac{Ca}{Pa}\right)^3$$

Ca: load rating, in newtons

Pa: equivalent load, in newtons

For the radical roller bearing, basic rating life should be calculated as:

$$L_{10} = \left(\frac{Cr}{Pr}\right)^{10/3}$$

Cr: load rating, in newtons

Pr: equivalent load, in newtons

For the thrust roller bearing, basic rating life should be calculated as:

$$L_{10} = \left(\frac{Ca}{Pa}\right)^{10/3}$$

Ca: load rating, in newtons

Pa: equivalent load, in newtons

$L_{10,\text{hours}}$ should be calculated as:

$$L_{10,\text{hours}} = \frac{L_{10}}{60n} \times 10^6$$

n, rotary speed, rpm

Then the $L_{10,\text{hours}}$ shall be converted to $L_{10,\text{years}}$ based on the operational time per year.

4.3 SYSTEM BOUNDARY

This PCR allows the following two scopes:

- Option A: A “cradle-to-grave” EPD, excluding product use; covering the upstream and core life cycle stages, and end-of-life processes. This option can also be used if the final application/product is known.
- Option B: A “cradle-to-grave” EPD covering all life cycle stages. This option shall be used if a functional unit is used and is only possible if the final application/product is known; see Section 4.2.2 for examples of final products.

4.3.1 LIFE-CYCLE STAGES

For the purpose of different data quality rules and for the presentation of results, the life cycle of the product is divided into three life cycle stages:

- Upstream processes (from cradle-to-gate)
- Core processes (from gate-to-gate)
- Downstream processes (from gate-to-grave)

In the EPD, the environmental performance associated with each of the life-cycle stages included within the system boundaries shall be reported separately and in aggregated form.

Benefits of reuse, recovery and recycling beyond the system boundaries may be calculated according to EN 15804 (Module D) and presented as additional environmental information in the EPD.

The common processes for bearing, bearing units and parts are described below. Sections 4.3.1.1–4.3.1.3 describe how these processes are assigned to the life-cycle stages.

For bearing and bearing units:

- Bearings: raw materials processing (extraction and manufacturing) – inner/outer ring processing (see details below), ball or roller processing (see details below), cage (stamping or solid) processing – bearing assembly – bearing packaging – installation – usage – end of life.

- Bearing units processing: raw materials processing (extraction and manufacturing) – inner/outer ring processing (see details below), ball or roller processing (see details below), cage (stamping or solid) processing, other parts processing – bearing and all parts assembly – bearing units packaging – installation – usage – end of life.

For the parts of bearings or bearing units

- Inner ring and outer rings: raw material processing – blanking – forging – spheroidizing annealing – turning processing – heat treatment – grinding – final inspection – rust prevention – packaging – installation – usage – end of life.
- Balls: raw material processing – cold blanking – cutting, soft grinding – heat treatment – hard grinding – fine grinding – final inspection – rust prevention, rough grinding – packaging – installation – usage – end of life.
- Roller: raw material processing – cold heading – string ring belt and soft grinding – heat treatment – rough grinding outer diameter – rough grinding end face – final grinding end face – fine grinding outer diameter – final grinding outer diameter – final inspection group – rust prevention – packaging – installation – usage – end of life.

4.3.1.1. Upstream processes

The following unit processes are part of the product system and shall be classified as upstream processes:

- Extraction and processing of raw materials.
- Recycling processes of secondary materials from other product life cycles, if relevant.
- Production of auxiliary products used in the core process.
- Production of main parts and components used in the core process (e.g., forging, rings, cages, rollers, etc.).
- Production of semi-products (e.g., primary inner/outer ring requiring further machining) used in the core process, if applicable.
- Production of distribution and consumer packaging.
- Transportation processes along the upstream supply chain to a distribution point (e.g., raw materials, auxiliary products, distribution and consumer packaging, main parts and components, semi-product to the factory stockroom or warehouse).
- Generation of electricity and production of fuels, steam and other energy carriers used in upstream processes.

Upstream processes not listed may also be included. All elementary flows shall be included, except for flows that may be excluded according to the general cut-off rule in Section 4.5. For example, materials or chemicals used for wastewater treatment in upstream processes are cut off in most cases due to the small amounts and minor environmental impact.

4.3.1.2. Core processes

The following unit processes are part of the product system and shall be classified as core processes:

- Further processing of semi-products before assembly, e.g., grinding and heat treatment of inner/outer ring of the bearing, steel ball or roller processing, or cage (stamping or solid) processing before assembly, if applicable.
- Transportation of materials, parts and components and semi-products within the manufacturing plant from distribution point.
- Assembly of the final product.
- Packaging of the manufactured product, if applicable and relevant.
- End-of-life treatment of manufacturing waste (e.g., slags, sludge, dust), even if carried out by third parties, including transportation, if relevant.
- Direct emissions generated in the core processes (e.g., NOx, SOx, heavy metals, PM).
- Generation of electricity and production of fuels, steam and other energy carriers used in core processes.

Core processes not listed may also be included. All elementary flows shall be included, except for flows that may be excluded according to the general cut-off rule in Section 4.5. The following processes shall not be included:

- Maintenance of machineries and other operations made occasionally (i.e. > 3 years frequency) or in emergency situations.
- Business travel of personnel.
- Travel to and from work by personnel.

- Research and development activities.

For modelling of infrastructure and capital goods, see Section 4.3.2.

Any other exclusion of unit processes shall be described and justified in the EPD.

4.3.1.3. Downstream processes

The following unit processes are part of the product system and shall be classified as downstream processes:

- Transportation of the product to distribution platform/retailer/consumer, until the user of the product.
- Product use and maintenance activities, e.g., installation of the product, use of lubricant, maintenance service of bearings, bearing units and parts.
- Frictional power loss during use stage; generation of electricity and production of fuels, stream and other energy carriers for the frictional power loss in the use of the bearings and bearing units.
- Disassembling/sorting, operations for the separation of product components and subsequent sorting, and recycling processes, if relevant.
- Final waste treatment processes for product and packaging (if relevant), for example landfill or incineration, it is necessary to declare the quantity of waste produced.
- Transportation of the discarded product and packaging to the final waste treatment processes or to subsequent sorting and recycling processes, if relevant.

4.3.2 INFRASTRUCTURE AND CAPITAL GOODS

In general, the production and end-of-life processes of infrastructure or capital goods[4] used in the product system should not be included within the system boundaries. They may be included when infrastructure and capital goods are known to be relevant in terms of their environmental impact, or when a generic LCI dataset includes infrastructure/capital goods, and it is not possible, within reasonable effort, to subtract the data on infrastructure/capital goods from this dataset. If an infrastructure/capital good is produced with the intention to be used one or a few times only (e.g., a manufacturing plant or machinery constructed to produce only one product), this infrastructure/capital good shall be included.

The inclusion or exclusion of infrastructure/capital goods shall be transparently described for upstream, core and downstream processes in the LCA report and in the EPD.

If infrastructure/capital goods are included, the following disclaimer shall be included in the results sections of the LCA report and in the EPD (land use and toxicity indicators shall only be mentioned if declared in the EPD):

The results of the impact categories abiotic depletion of minerals and metals, land use, human toxicity (cancer), human toxicity, non-cancer and ecotoxicity (freshwater) may be highly uncertain in LCAs that include capital goods/infrastructure in generic datasets, in case infrastructure/capital goods contribute greatly to the total results. This is because the LCI data of infrastructure/capital goods used to quantify these indicators in currently available generic datasets sometimes lack temporal, technological and geographical representativeness. Caution should be exercised when using the results of these indicators for decision-making purposes.

4.3.3 OTHER BOUNDARY SETTING

4.3.3.1. Boundary towards nature

Boundaries to nature are defined as where the flows of material and energy resources leaves nature and enters the technical system (i.e. the product system). Emissions cross the system boundary to nature when they are emitted to air, soil or water.

[4] Examples of infrastructure and capital goods are the building in which the studied product or upstream materials or components are produced, machinery used in the manufacturing of the product or its materials or components, or vehicles used in transports in the product system. For example, if the EPD is on wind power, the power plant itself is considered the studied product and not infrastructure/capital goods. However, the buildings and machinery that make the wind turbine components are considered infrastructure/capital goods. Similarly, if the EPD is on a means of transport, the vehicle is considered the studied product and not infrastructure/capital goods.

4.3.3.2. Boundary towards other technical systems

Boundaries towards other technical systems define the flow of materials and components to/from the product system under study and from/to other product systems. If there is an inflow of recycled material to the product system in the production/manufacturing stage, the transport from the scrapyard/collection site to the recycling plant, the recycling process, and the transportation from the recycling plant to the site where the material is being used shall be included. If there is an outflow of material or component to recycling, the transportation of the material to the scrapyard/collection site shall be included. The material or component going to recycling is then an outflow from the product system.

See Section 4.6 for further guidance.

4.3.3.3. Temporal boundary

The temporal boundary defines the time period for which the life cycle inventory data is recorded, e.g. for how long emissions from waste deposits are accounted. As default, the time period over which inputs to and outputs from the product system is accounted for shall be 100 years from the year that the LCA model best represents, considering the representativeness of the inventory data. This year shall, as far as possible, represent the year of the publication of the EPD.

4.3.3.4. Geographical boundary

The geographical boundary defines the geographical coverage of the LCA. This shall reflect the physical reality of the product under study, accounting for the representativeness of technology, input materials and input energy.

4.4 SYSTEM DIAGRAM

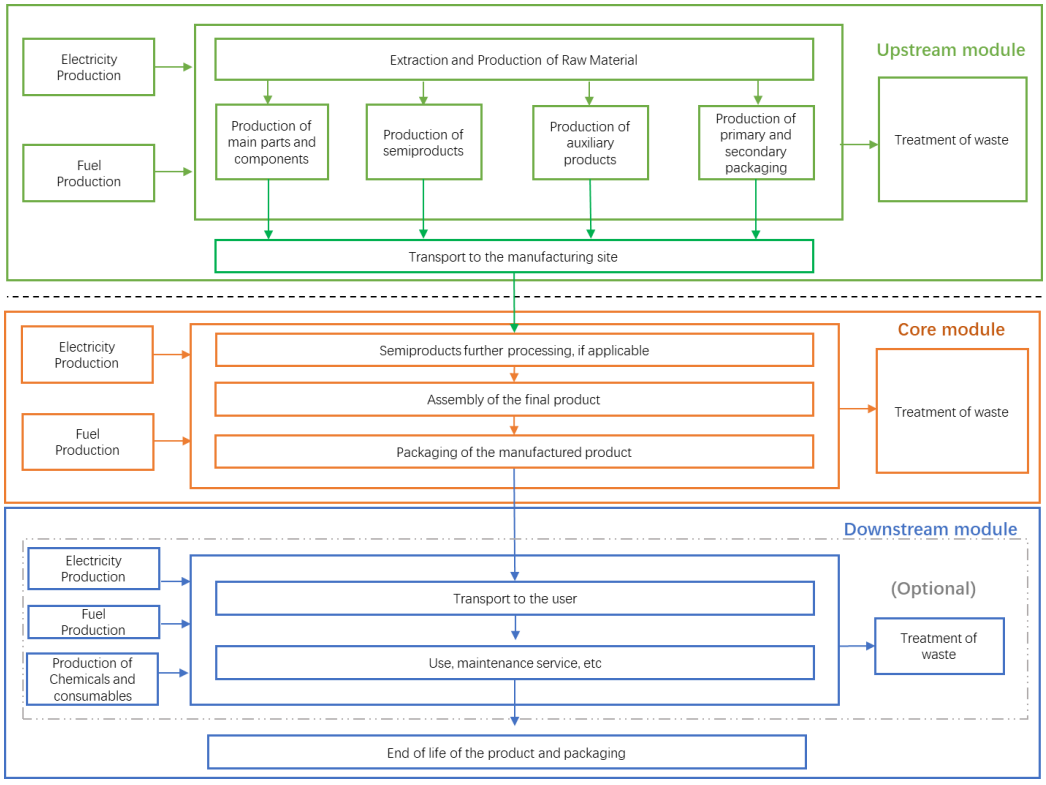


Figure 2 *System diagram illustrating the processes that shall or may be included in the product system, divided into upstream, core and downstream processes (if a cradle to grave EPD is selected). The illustration of processes to include may not be exhaustive. If any omission of lifecycle stages and processes are made, the system diagram should indicate it.*

4.5 CUT-OFF RULES

A cut-off rule of maximum 5% shall be applied. In other words, the included inventory data (not including inventory data of processes that are explicitly outside the system boundary as described in Section 4.34.2.1) shall together give rise to at least 95% of the results of any of the environmental impact categories. Also, at least 95% of the mass of the product content and at least 95% of the energy use of the product life cycle shall be accounted for. The cut-off of inventory data should, however, be avoided, and all available inventory data shall be used.

The cut-off of inventory data, based on the above cut-off rule, should be an output of a sensitivity analysis, alone or in combination with expert judgment based on experience of similar product systems. Further, the cut-off shall be possible to verify in the verification process, hence the exclusion of inventory data based on the cut-off rule shall be documented in the LCA report, and the EPD developer shall provide the information the verifier considers necessary to verify the cut-off.

The reasons for deviating from the 1% cut-off rule the GPI are that:

- Inhouse manufacturing of bearings has many processes. The material and energy use are small for several processes and measuring and collecting this data would require a large amount of resources.
- To harmonize with the cut-off rule for construction products (see PCR 2019:14 Construction products).

4.6 ALLOCATION RULES

Allocation can be divided into allocation of co-products, i.e. allocation of unit processes that generate several products, and allocation of waste, i.e. allocation of unit processes that generate materials that are, for example, landfilled recovered, recycled or reused, and which require further processing to cease being waste and become products (see criteria for end-of-waste state in Section 4.6.2).

The principles for allocation of co-products and allocation of waste are described separately in the following subsections

4.6.1 CO-PRODUCT ALLOCATION

The following hierarchy of allocation methods shall be followed for co-product allocation:

1. Allocation shall be avoided, if possible, by dividing the process to be allocated into sub-processes and collecting the inventory data for each sub-process.
2. If allocation cannot be avoided, the inventory data should be partitioned between the different co-products in a way that reflects the underlying physical relationships between them, i.e. allocation should reflect the way in which the inventory data changes if the quantities of delivered co-products change.
3. If a physical relationship between the inventory data and the delivery of co-products cannot be established, the inventory data should be allocated between the co-products in a way that reflects other relationships between them. For example, inventory data might be allocated between co-products in proportion to their economic values. If economic allocation is used, a sensitivity analysis exploring the influence of the choice of the economic value shall be included in the LCA report.

4.6.2 ALLOCATION OF WASTE TREATMENT PROCESSES

Allocation of waste shall follow the polluter pays principle and its interpretation in EN 15804: “processes of waste processing shall be assigned to the product system that generates the waste until the end-of-waste state is reached.” The end-of-waste state is reached when all the following criteria for the end-of-waste state are fulfilled (adapted from EN 15804):

- The recovered material, component or product is commonly used for specific purposes;
- A market or demand, identified e.g. by a positive economic value, exists for such a recovered material, component or product;
- The recovered material, component or product fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and
- The use of the recovered material, product or construction element will not lead to overall adverse environmental or human health impacts.

The above outlined principle means that the generator of the waste shall carry the full environmental impact until the point in the product life cycle in which the end-of-waste criteria are fulfilled. Waste may have a negative economic market value, and then the end-of-waste stage is typically reached after (part of) the waste processing and further refinement, at the point at which the waste no

longer has a negative market value. This allocation method is (in most cases) in line with a waste generator's juridical and financial responsibilities. See the GPI for further information and examples.

For waste being recycled or reused, processes after the end-of-waste state, if any, shall be attributed to the product system using the recycled/reused material flow (recycled materials are thereafter considered secondary raw materials).

Above allocation rules are valid both for scraps used as input in the upstream stage (i.e., carrying the environmental impacts of transport and pre-treatment, not the impacts generated in the earlier lifecycle) and waste produced in the core stage (i.e. carrying the environmental impacts of waste treatment).

Even if benefits of reuse, recycling or recovery beyond the system boundaries (e.g., benefits of a recycled material replacing virgin material production) by default shall be considered to be outside the system boundaries, LCA results on the potential environmental benefits of reuse, recycling and recovery may be declared separately as additional environmental information (see Section 5.4.6). If such LCA results are declared, they shall be calculated according to the rules of modelling module D in EN 15804.

4.7 DATA QUALITY REQUIREMENTS AND SELECTION OF DATA

Life cycle inventory data are classified into specific data and generic data, where the latter can be selected generic data or proxy data. The data categories are defined as follows:

- Specific data (also referred to as "primary data" or "site-specific data"):
  - Data gathered from the actual manufacturing plant where product-specific processes are carried out;
  - Actual data from other parts of the life cycle traced to the product under study, for example site-specific data on the production of materials or generation of electricity provided by contracted suppliers, and transportation data on distances, means of transportation, load factor, fuel consumption, etc., of contracted transportation providers; and
  - LCI data from databases on transportation and energyware that is combined with actual transportation and energy parameters as listed above.
- Generic data (sometimes referred to as "secondary data"), divided into:
  - Selected generic data: data (e.g. commercial databases and free databases) that fulfil prescribed data quality requirements for precision, completeness, and representativeness (see below Section 4.7.1),
  - Proxy data: data (e.g. commercial databases and free databases) that do not fulfil all of the data quality requirements of "selected generic data".

Specific data shall be used for the core processes. Specific data shall be used for upstream and downstream processes, when available, otherwise generic data may be used. Generic data should be used in cases in which they are representative for the purpose of the EPD, e.g. for bulk and raw materials on a spot market, if there is a lack of specific data on the final product or if a product consists of many components.

4.7.1 RULES FOR USING GENERIC DATA

For generic data to be classified as "selected generic data", the following requirements apply:

- Datasets shall be based on attributional LCA modelling (e.g., not be based on marginal data and not include credits from system expansion),
- The reference year shall be as current as possible and should be representative for the validity period of the EPD,
- The total maximum 5% cut-off rule (as described in Section A.3.3) shall be met on the level of the product system,
- Datasets shall represent average values for a specific reference year; however, how data are generated could vary, e.g. over time, and then they should have the form of a representative annual average value for a specified reference period (such deviations shall be justified and declared in the EPD), and
- the representativeness of the data shall be fully representative for the given temporal, technological and geographical context.

If selected generic data that meets the above data quality requirements are not available, proxy data may be used. The environmental impacts associated with proxy data shall not exceed 10% of the overall environmental impact of the product system. The mass associated with proxy data shall not exceed 5% of the product content.

4.7.2 EXAMPLES OF DATABASES FOR GENERIC DATA

All commercial or publicly available databases that meet the data quality requirements maybe used. The specifications and the version of the database shall be reported in the EPD.

Some recommended databases are the Ecoinvent database (www.environdec.com), the World Steel Association database (www.worldsteel.org) and the Gabi professional database (https://gabi.sphera.com/).

4.7.3 DATA QUALITY REQUIREMENTS AND OTHER MODELLING GUIDANCE PER LIFE-CYCLE STAGE

Below are further data quality requirement per life-cycle stage. Exceptions to the requirements may be accepted, if justified in the EPD; such exceptions are subject to the approval by the verifier on a case-to-case basis.

4.7.3.1. Upstream processes

- Data referring to processes and activities upstream in a supply chain over which the EPD owner direct management control shall be specific and collected on site.
- Data on main parts, packaging, or main auxiliaries should be requested from the contractor as specific data, as well as infrastructure, where relevant. In particular, bearing steel production should refer to specific data. If not available, the use and choice of generic data shall be justified.
- Data on transport of main parts and components along the supply chain to the manufacturing plant/place, should be specific and based on the actual transportation mode, distance from the supplier, and vehicle load.
- In case specific data is lacking, selected generic data may be used. If this is also lacking, proxy data may be used (see Section 4.7).
- For upstream processes modelled with specific data, generation of electricity used shall be accounted for in this priority:

    1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
    2. Residual electricity mix of the electricity supplier on the market.
    3. Residual electricity mix on the market.
    4. Electricity consumption mix on the market.

    The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total consumption mix.

    “The market” in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA.

    The mix of electricity used in upstream processes shall be documented in the EPD, where relevant. Renewable energy from wind power, solar power, biomass, etc., and different kinds of renewable electricity certifications which are used for specific products with less environmental influence shall be declared and shall not be double-counted.

4.7.3.2. Core processes

- Further processing of semi-products: Specific data shall be used for the energy and auxiliary materials consumption, where relevant.
- In the event that core processes are done at several sites in series, transport between each site shall be considered.
- Specific data shall be used for the assembly of the product and for the manufacture of main parts as well as for on-site generation of steam, heat, electricity, etc., where relevant.
- Waste treatment processes of manufacturing waste should be based on specific data, if available.
- For electricity used in the core processes, generation of electricity used shall be accounted for in this priority:

1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
2. Residual electricity mix of the electricity supplier on the market.
3. Residual electricity mix on the market.
4. Electricity consumption mix on the market. This option shall not be used for electricity used in processes over which the manufacturer (EPD owner) has direct control[5].

The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total consumption mix.

"The market" in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA.

The mix of electricity used in the core processes shall be documented in the EPD, where relevant. Renewable energy from wind power, solar power, biomass, etc., and different kinds of renewable electricity certifications which are used for specific products with less environmental influence shall be declared and shall not be double-counted.

4.7.3.3. Downstream processes

- Data for the use stage are usually based on scenarios, but specific data should be used when available and relevant.
- Data on the emissions from the use stage should be based on documented tests, verified studies in conjunction with average or typical product use, or recommendations concerning suitable product use. Whenever applicable, test methods shall be internationally recognised.
- 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 for in the following priority:

    1. Residual electricity mix on the market.
    2. Electricity consumption mix on the market.

  The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total production mix.

  "The market" in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA.

  The mix of electricity used in the downstream processes shall be documented in the EPD, where relevant. Renewable energy from wind power, solar power, biomass, etc., and different kinds of renewable electricity certifications which are used for specific products with less environmental influence shall be declared and shall not be double-counted.
- The transport of the product to the customer shall be described in the EPD, where relevant, and be accounted for in this priority:

    1. Actual transportation modes and distances to specific a customer or market, representing the geographical scope of the EPD.
    2. A weighted average of transportation modes and distances, based on transportation to several customers or markets, representing the geographical scope of the EPD.
    3. A default transportation scenario depending on the geographic scope of the EPD: a. National supply chain: 600 km by truck b. Continental supply chain: 600 km by truck and 10 000km by train c. Intercontinental supply chain: 600 km by truck and 20 000km by sea.

[5] For electricity markets without trade of Guarantees of Origin (or similar), the residual mix will, however, be identical to the consumption mix.

- Scenarios for the end-of-life stage (e.g. recycling or remanufacturing) shall be technically and economically practicable and compliant with current regulations in the relevant geographical region based on the geographical scope of the EPD. Key assumptions regarding the end-of-life stage scenario shall be documented in the EPD report.
- Use of lubricant, maintenance activities should be based on documented tests, verified studies in conjunction with average or typical product use, or recommendations concerning suitable product use.
- Frictional power loss during use stage should be based on the ISO/TR 14179-2 calculation.
- For the use and maintenance, the period for calculation shall be based on the lifespan of the product or the RSL of the final product (Section 4.2).
- For the Frictional power loss, the calculation shall be based on ISO/TR 14179-2. The bearing loss torque, T_{VL}, in Newton metres, is split into no-load, T_{VL0},and load-dependent, T_{VLP1}, parts. In the case of axially loaded cylindrical roller bearings and axially needle roller bearings, an additional loss term, T_{VLP2}, occurs, which is dependent on the magnitude of the end thrust.

  These components are calculated separately and then added together to give the following for the total loss torque:

$$T_{VL} = T_{VL0} + T_{VLP1} + T_{VLP2}$$

  From the calculated loss torque, T_{VL}, it is possible to calculate the total bearing power loss, P_{VL}, as follows,

$$P_{VL} = \sum_{i=1}^{bearing} (T_{VLi}\,\omega_i) = \sum_{i=1}^{bearing} (T_{VLi}\frac{\pi n_i}{30})$$

  P_{VL}: total bearing power loss, W.

  ω_i: Angular velocity of bearing rotation, rad/s.

  n_i: Bearing rotation speed, rpm.

4.7.4 DATA QUALITY DECLARATION

For specific data, the following data quality specifications shall be declared in the EPD:

- All data should represent the same time period and this time period shall be declared in the EPD.
- If specific data is not accessible from contractors or from suppliers for upstream data, this shall be declared in the EPD.
- The percentage of specific data in contribution to the results of GWP-total indicator shall be declared in the EPD.

For generic data, a data quality assessment may be declared in EPD. For this, the Data Quality Rating (DQR) provided in the Product Environmental Footprint (PEF) method (European Commission 2021). The DQR calculation is based on three data quality criteria, as follows:

$$DQR = (Ter + GR + TiR)\ /3$$

where

Ter is the technological representativeness,

GR is the geographical representativeness, and

TiR is the time-related representativeness.

The representativeness (technological, geographical, and time-related) characterises to what degree the processes and products selected are depicting the system analysed. Value spans from “1” to “5”, “1” being the best quality and “5” the worst quality, see Table 5. For more information of how to conduct such an assessment, see European Commission (2021). In the above formula, the precision criteria included in the DQR formula provided in the PEF method has been removed since it is not relevant for the data quality assessment of generic datasets. DQR of 5 shall be taken as a conservative assumption when no secondary datasets quality assessment is possible.

Table 5 Overview of the DQR system of the PEF method (European Commission 2021).

Global evaluation of the data quality (DQR)	**Global data quality level**
DQR ≤ 1.5	Excellent
1.5 < DQR ≤ 2.0	Very good quality

2.0 < DQR ≤ 3.0	Good quality
3 < DQR ≤ 4.0	Satisfactory quality
DQR > 4	Poor quality

4.8 ENVIRONMENTAL PERFORMANCE INDICATORS

The EPD shall declare the default environmental performance indicators and their methods as described at the website www.environdec.com/indicators, which includes both inventory indicators and indicators of potential environmental impact. The source and version of the impact assessment methods and characterisations factors used shall be reported in the EPD. Alternative regional impact assessment methods and characterisation factors may be calculated and displayed in addition to the default list. If so, the EPD shall contain an explanation of the difference between the different sets of indicators, as they may appear to the reader to display duplicate information.

If the default list of environmental performance indicators and methods at the website is updated, the previous version of the list is valid in parallel to the new version during a transition period of 90 days, as described at the website.

Apart from the required inventory indicators, other inventory data may also be declared in the EPD, if relevant and useful for EPD users. Such data shall not be declared in the main body of the EPD, but in an annex.

4.9 INCLUDING MULTIPLE PRODUCTS IN THE SAME EPD

4.9.1 MULTIPLE PRODUCTS FROM THE SAME COMPANY

Several sets of results, reflecting different products, are not allowed to be declared in the same EPD. However, similar products from a single or several manufacturing sites covered by the same PCR and manufactured by the same company with the same major steps in the core processes may be grouped and thereby included in the same EPD. For such an EPD, there are three options:

- For each indicator, declare the average results of the included products. This average shall be weighted according to the production volumes of the included products, if relevant. In this option, the average content shall be declared in the content declaration.
- Declare the results of one of the included products – a representative product. The choice of the representative product shall be justified in the EPD, using, where applicable, statistical parameters. For example, the choice may be based on production volumes. In this option, the content of the representative product shall be declared in the content declaration.
- For each indicator, declare the highest result of the included products (i.e., the results of a “worst-case product”, which may be the results of one or several of the included products). In this option, the content declaration shall include the lowest amounts of recycled and biogenic content of the included products and their packaging, respectively, and the information on environmental and hazardous properties of substances shall reflect the highest share and most hazardous such substances contained in any of the included products.

The first two options are only possible if none of the declared environmental impact indicator results differ by more than 10% between any of the included products. The third option is possible also if variations are larger than 10%.

The option chosen shall be clearly described in the EPD.

4.9.2 SECTOR EPDS

The International EPD® System allows for an industry association to develop an EPD in the form of a Sector EPD. A Sector EPD declares the average product of multiple companies in a clearly defined sector in a clearly defined geographical area. Products covered in a sector EPD shall follow the same PCR and the same declared/functional unit shall be applied.

Any communication of the results from a Sector EPD should contain the information that the results are based on averages obtained from the sector as defined in the EPD. The communication shall not claim that the sector EPD results are representative for a certain manufacturer or its product.

The following information shall also be included in a Sector EPD:

- A list of the contributing manufacturers that the Sector EPD covers,

- A description of how the selection of the sites/products has been done and how the average has been determined, and
- A statement that the document covers average values for an entire or partial product category (specifying the percentage of representativeness) and, hence, the declared product is an average that is not available for purchase on the market.

5 CONTENT AND FORMAT OF EPD

EPDs based on this PCR shall contain the information described in this section. Flexibility is allowed in the formatting and layout provided that the EPD still includes the prescribed information. A generic template for EPDs is available at www.environdec.com.

The EPD content shall:

- Be in line with the requirements and guidelines in ISO 14020 (Environmental labels and declarations – General principles),
- Be verifiable, accurate, relevant and not misleading, and
- Not include rating, judgements or direct comparison with other products[6].

An EPD should be made with a reasonable number of pages for the intended audience and use.

The content of EPDs published in machine-readable format shall correspond with the content of the underlying EPD.

5.1 EPD LANGUAGES

EPDs should be published in English but may also be published in additional languages. If the EPD is not available in English, it shall contain an executive summary in English including the main content of the EPD. This summary is part of the EPD and, thus, also subject to the verification process.

5.2 UNITS AND QUANTITIES

The following requirements apply for units and quantities:

- The International System of Units (SI units) shall be used where available, e.g., kilograms (kg), Joules (J) and metres (m). Reasonable multiples of SI units may be decided in the PCR to improve readability, e.g., grams (g) or megajoules (MJ). The following exceptions apply:
  - Resources used for energy input (primary energy) should be expressed as kilowatt-hours (kWh) or megajoules (MJ), including renewable energy sources, e.g., hydropower, wind power and geothermal power.
  - Water use should be expressed in cubic metres (m^3).
  - Temperature should be expressed in degrees Celsius (°C).
  - Time should be expressed in the units most practical, e.g., seconds, minutes, hours, days or years.
  - Results of the environmental performance indicators shall be expressed in the units prescribed by the impact assessment methods, e.g. kg CO_2 equivalents.
- Three significant figures[7] should be adopted for all results. The number of significant digits shall be appropriate and consistent.
- Scientific notation may be used, e.g. 1.2E+2 for 120, or 1.2E-2 for 0.012.
- The thousand separator and decimal mark in the EPD shall follow one of the following styles (a number with six significant figures shown for illustration):
  - SI style (French version): 1 234,56
  - SI style (English version): 1 234.56

  In case of potential confusion or intended use of the EPD in markets where different symbols are used, the EPD shall state what symbols are used for thousand separator and decimal mark.
- Dates and times presented in the EPD should follow the format in ISO 8601. For years, the prescribed format is YYYY-MM-DD, e.g., 2017-03-26 for March 26th, 2017.

[6] Therefore, results of normalization are not allowed to be reported in the EPD.

[7] Significant figures are those digits that carry meaning contributing to its precision. For example with two significant digits, the result of 123.45 shall be displayed as 120, and 0.12345 shall be displayed as 0.12. In scientific notation, these two examples would be displayed as $1.2*10^2$ and $1.2*10^{-2}$.

- The result tables shall:
  - Only contain values or the letters “ND” (Not Declared). It is not possible to specify ND for mandatory indicators. ND shall only be used for voluntary parameters that are not quantified because no data is available.[8]
  - Contain no blank cells, hyphens, less than or greater than signs or letters (except “ND”).
  - Use the value “0” only for parameters that have been calculated to be zero.
  - Footnotes shall be used to explain any limitation to the result value.

5.3 USE OF IMAGES IN EPD

Images used in the EPD, especially pictures featured on the cover page, may in themselves be interpreted as an environmental claim. Images such as trees, mountains, wildlife that are not related to the declared product shall therefore be used with caution and in compliance with national legislation and best available practices in the markets in which the EPD is intended to be used.

5.4 EPD REPORTING FORMAT

The reporting format of the EPD shall include the following sections:

- Cover page (see Section 5.4.1)
- Programme information (see Section 5.4.2)
- Product information (see Section 5.4.3)
- Content declaration (see Section □)
- Environmental performance (see Section 5.4.5)
- Additional environmental information (see Section 5.4.6)
- Additional social and economic information (see Section 5.4.7)
- References (see Section 5.4.9)

The following sections shall be included, if relevant:

- Differences versus previous versions (see Section 5.4.8)
- Executive summary in English (see Section 5.4.10)

5.4.1 COVER PAGE

The cover page shall include:

- Product name and image
- Name and logotype of EPD owner
- The text “Environmental Product Declaration” and/or “EPD”
- Programme: The International EPD® System, www.environdec.com
- Programme operator: EPD International AB
- Logotype of the International EPD® System
- EPD registration number as issued by the programme operator[9]
- Date of publication (issue): 20XX-YY-ZZ

[8] This requirement does not intend to give guidance on what indicators are mandated (“shall”) or voluntary.

[9] The EPD shall not include a “registration number” if such is provided by the certification body, as this may be confused with the registration number issued by the programme operator.

- Date of revision: 20XX-YY-ZZ, when applicable
- Date of validity; 20XX-YY-ZZ
- A note that *"An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com."*
- A statement of conformity with ISO 14025.
- For EPDs covering multiple products: a statement that the EPD covers multiple products and a list of all products covered by the EPD.
- For Sector EPDs: a statement that the EPD is a Sector EPD.
- For construction product EPDs:

In the case of EPDs registered through a regional hub (a regional or national programme based on and fully aligned with the International EPD® System through an agreement with the programme operator), "Programme", "Programme operator", and "Logotype" shall be expanded to include a reference to the regional programme and the organisation responsible for it.

Where applicable, the cover page shall also include the following information:

- Information about dual registration of EPD in another programme, such as registration number and logotype.
- A statement of conformity with other standards and methodological guides.

5.4.2 PROGRAMME INFORMATION

The programme information section of the EPD shall include:

- Address of programme operator: *EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden, E-mail: info@environdec.com*
- The following statement on the requirements for comparability of EPDs, adapted from ISO 14025: *"EPDs within the same product category but from different programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison."*
- A statement that the EPD owner has the sole ownership, liability and responsibility of the EPD
- Information about verification[10] and the PCR in a table with the following format and contents:

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
PCR: *<name, registration number, version and UN CPC code(s)>*
PCR review was conducted by: *<name and organisation of the review chair, and information on how to contact the chair through the programme operator>*
Life cycle assessment (LCA)
LCA accountability: *<name, organization>*
Third-party verification

[10] If the EPD has been verified by an approved individual verifier who has received contractual assistance from a certification body that is not accredited, this certification body shall not be included in this table.

Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by individual verifier Third-party verifier: <*name, organisation, and signature of the third-party verifier*> Approved by: The International EPD® System
OR
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by accredited certification body Third-party verification: <name, organisation> is an approved certification body accountable for the third-party verification The certification body is accredited by: <*name of accreditation body & accreditation number, where applicable*>
OR
Independent third-party verification of the declaration and data, according to ISO 14025:2006 via: ☐ EPD verification by EPD Process Certification* Internal auditor: <*name, organisation*> Third-party verification: <name, organisation> is an approved certification body accountable for third-party verification Third-party verifier is accredited by: <*name of accreditation body & accreditation number, where applicable*> *For EPD Process Certification, an accredited certification body certifies and reviews the management process and verifies EPDs published on a regular basis. For details about third-party verification procedure of the EPDs, see GPI v4, Section 7.5.
Procedure for follow-up of data during EPD validity involves third-party verifier[11]: ☐ Yes ☐ No

5.4.3 PRODUCT INFORMATION

The product information section of the EPD shall include:

- Address and contact information to EPD owner,
- Description of the organisation. This may include information on products- or management system-related certifications (e.g. ISO 14024 Type I environmental labels, ISO 9001- and 14001-certificates and EMAS-registrations) and other relevant work the organisation wants to communicate (e.g. SA 8000, supply-chain management and social responsibility),
- Name and location of production site,
- Product identification by name, and an unambiguous identification of the product by standards, concessions or other means,

[11] Procedure for follow-up the validity of the EPD is at minimum required once a year with the aim of confirming whether the information in the EPD remains valid or if the EPD needs to be updated during its validity period (see Sections 7.3.2 and 7.4.9 of the GPI). The follow-up can be organized entirely by the EPD owner or together with the original verifier via an agreement between the two parties. In both approaches, the EPD owner is responsible for the procedure being carried out. If a change that requires an update (see Section 6.5 of the GPI) is identified, the EPD shall be re-verified by a verifier.

- Identification of the product according to the UN CPC scheme system. Other relevant codes for product classification may also be included, e.g.
  - Common Procurement Vocabulary (CPV),
  - United Nations Standard Products and Services Code® (UNSPSC),
  - Classification of Products by Activity (NACE/CPA),
  - Australian and New Zealand Standard Industrial Classification (ANZSIC), or
  - Global Trade Item Number (GTIN).
- A description of the product,
- A description of the technical purpose of the product, including its application/intended use,
- A description of the background system, including the main technological aspects,
- For EPDs covering multiple products: a description of the selection of products/sites, a list of contributing manufacturers (if Sector EPD), etc. (see Section 4.9),
- Geographical scope of the EPD, i.e., for which geographical location(s) of use and end-of-life the product's performance has been calculated,
- Declared/functional unit,
- Reference service life (RSL) and/or technical/actual lifespan, if relevant,
- Declaration of the year(s) covered by the data used for the LCA calculation and other relevant reference years,
- Reference to the main database(s) for generic data and LCA software used, if relevant,
- System diagram of the processes included in the LCA, divided into the life cycle stages,
- Description if the EPD system boundary is "cradle-to-gate", "cradle-to-gate with options" or "cradle-to-grave",
- Information on which life-cycle stages are not considered (if any), with a justification of the omission, and
- References to any relevant websites for more information or explanatory materials,
- Name and contact information of organisation carrying out the underlying LCA study.

This section may also include:

- If the product is suitable for remanufacturing,
- Any additional information about the underlying LCA-based information, such as cut-off rules, data quality, allocation methods, and other methodological choices and assumptions,
- A description of the material properties of the product with a declaration of relevant physical or chemical product properties, such as density, etc., and
- If end-of-life treatment is not included, the EPD shall contain a statement that it shall not be used for communicating environmental information to consumers/end users of the product.

5.4.4 CONTENT DECLARATION

The content declaration section shall declare the weight of one unit of product, as purchased, and contain information about the content of the product in the form of a list of materials and chemical substances including information on their environmental and hazardous properties. The gross weight of each material/substance shall be declared, including a minimum of 99% of the materials/substances in one unit of product.

The content declaration does not apply to proprietary materials and substances covered by exclusive legal rights including patent and trademarks. In general, an indication that a product is "free" of a specific hazardous material or substance should be done with caution and only when relevant, following the rules in ISO 14021 on self-declared environmental claims.

Information on the hazardous properties of materials and chemical substances should follow the requirements given in the latest revision of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS),[12] issued by the United Nations or national or regional applications of the GHS. As an example, the following regulations should be used for EPDs intended to be used in the European Union:

- Regulation (EC) No 1907/2006 of the European parliament and of the council of 18 December 2006 concerning the Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH); and
- Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling, and packaging of substances and mixtures.

5.4.4.1. Information about recycled materials

When a product is made in whole or in part with recycled materials, the provenience of the materials (pre-consumer or post-consumer) shall be presented in the EPD as part of the content declaration.

To avoid any misunderstanding about which material that may be considered “recycled material”, the guidance given in ISO 14021 shall be considered. In brief, the standard states that:

- Only pre-consumer or post-consumer materials (scraps) shall be considered in the accounting of the recycled materials, and
- Materials coming from scrap reutilisation (such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it) shall not be considered as recycled content.

5.4.4.2. Information about packaging

As packaging is strongly connected with the product, the producer shall provide information about packaging in the EPD, when applicable. Packaging may be classified as:

- Distribution Packaging: packaging designed to contain one or more articles or packages, or bulk materials, for the purposes of transport, handling and/or distribution (ISO 21067-1:2016, Section 2.2.6)
- Consumer Packaging: packaging constituting, with its content, a sales unit for the final user or consumer at the point of retail (ISO 21067-1:2016, Section 2.2.7).

Consumer packaging is generally the outcome of eco-design processes, or other activities, under direct control of the organisation. Many critical categories with strict legal requirements belong to consumer packaging category like food contact packaging and pharmaceutical packaging.

The type and function of the packaging shall be reported in the EPD.

A statement of the source of the materials (pre-consumer or post-consumer) shall be presented in the EPD when the packaging is made in whole or in part by recycled materials.

5.4.5 ENVIRONMENTAL PERFORMANCE

Below subsections list the mandatory environmental performance indicators to declare in the EPD. LCA results based on additional indicators may be declared, if they are relevant for the product category, their inclusion is justified in the EPD, appropriate methods are used, and the results are verifiable. If the additional indicators appear to the reader to display duplicate information, the EPD shall contain an explanation of the differences between the declared indicators.

5.4.5.1. Environmental impacts

The EPD shall declare the environmental impact indicators, per declared/functional unit, per life-cycle stage and in aggregated form, using the default impact categories, impact assessments methods and characterisation factors available at www.environdec.com. The source and version of the impact assessment methods and characterisation factors used shall be reported in the EPD.

[12] The GHS document is available at www.unece.org.

Alternative regional life cycle impact assessment methods and characterisation factors may be calculated and displayed in addition to the default list. If so, the EPD shall contain an explanation of the difference between the different sets of indicators, as they may appear to the reader to display duplicate information.

5.4.5.2. Use of resources

The EPD shall declare the mandatory, and may declare the optional, indicators for resource use listed at www.environdec.com/indicators per declared/functional unit, per life-cycle stage and in aggregated form.

5.4.5.3. Waste production and output flows

Waste generated along the whole life cycle production chains shall be treated following the technical specifications described in the GPI. The EPD may declare the optional indicators for waste production and output flows as listed at www.environdec.com/indicators per declared/functional unit, per life-cycle stage and in aggregated form.

5.4.6 ADDITIONAL ENVIRONMENTAL INFORMATION

An EPD may declare additional environmentally relevant information, in addition to the LCA results of the section on environmental performance results. The additional environmental information may cover various aspects of specific relevance for the product, for example:

- The release of dangerous substances into indoor air, soil, and water during the use stage,
- Instructions for proper use of the product, e.g. to minimise energy or water consumption or to improve the durability of the product,
- Instructions for proper maintenance and service of the product, e.g. to minimise energy or water consumption or to improve the durability of the product,
- Information on key parts of the product that determine its durability,
- Information on recycling including, e.g. suitable procedures for recycling the entire product or selected parts and the potential environmental benefits gained,
- Information on a suitable method of reuse of the product (or parts of the products) and procedures for disposal as waste at the end of its life cycle,
- Information regarding disposal of the product, or inherent materials, and any other information considered necessary to minimise the product's end-of-life impacts, and
- A more detailed description of an organisation's overall environmental work, in addition to the information listed under Section 5.4.3, such as:
  - The existence of any type of organised environmental activity, and
  - Information on where interested parties may find more details about the organisation's environmental work.
- Information for better service of the product, e.g the REP (Rotating Equipment Performance) technology to make a real-time monitoring of the rotation process, minimize unplanned downtime, reduce raw material consumption and improve the durability of the product.

Any additional environmental information declared shall be substantiated and verifiable, and be derived using appropriate methods and be specific, accurate, not misleading, and relevant to the specific product. Quantitative information is preferred over qualitative information.

5.4.7 ADDITIONAL SOCIAL AND ECONOMIC INFORMATION

The EPD may also include other relevant social and economic information as additional and voluntary information. This may be product information or a description of an organisation's overall work on social or economic sustainability, such as activities related to supply chain management or social responsibility.

Any additional social and economic information declared shall be substantiated and verifiable, and be derived using appropriate methods and be specific, accurate, not misleading, and relevant to the specific product. Quantitative information is preferred over qualitative information.

5.4.8 DIFFERENCES VERSUS PREVIOUS VERSIONS

For EPDs that have been updated, the following information shall be included:

- a description of the differences versus previously published versions, and
- a revision date on the cover page.

5.4.9 REFERENCES

A reference section shall be included, including a list of all sources referred to in the EPD, including the GPI (including version number), and PCR (registration number, name, and version) used to develop the EPD.

5.4.10 EXECUTIVE SUMMARY IN ENGLISH

The executive summary, if included (see Section 5.1), shall contain relevant summarised information related to the programme, product, environmental performance, information related to pre-certified EPDs, and information related to sector EPDs. Besides this, further information may be added such as additional environmental, social or economic information, references as well as differences versus previous EPD versions.

6 LIST OF ABBREVIATIONS

ANZSIC	Australian and New Zealand Standard Industrial Classification
CPC	Central product classification
CPV	Common procurement vocabulary
EPD	Environmental product declaration
GPI	General Programme Instructions
GTIN	Global trade item number
ISO	International Organization for Standardization
LCA	Life cycle assessment
LCI	Life cycle inventory
NACE/CPA	Classification of products by activity
ND	Not declared
PCR	Product category rules
REACH	Restriction of chemicals
RSL	Reference service life
SI	The International System of Units
UN	United Nations
UNSPSC	United Nations standard products and services code

7 REFERENCES

CEN (2013) EN 15804:2012+A1:2013, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

CEN (2019) EN 15804:2012+A2:2019, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

EPD International (2021) General Programme Instructions for the International EPD® System. Version 4.0, dated 2021-03-29. www.environdec.com.

European Commission (2021) Annexes 1 to 2. Available at: https://environment.ec.europa.eu/publications/recommendation-use-environmental-footprint-methods_en. Accessed April 2023.

ISO (2000) ISO 14020:2000, Environmental labels and declarations – General principles.

ISO (2001) ISO/TR 14179-2:2001, Gears — Thermal capacity — Part 2: Thermal load-carrying capacity.

ISO (2004) ISO 8601:2004 Data elements and interchange formats – Information interchange – Representation of dates and times.

ISO (2006a) ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures.

ISO (2006b) ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework.

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

ISO (2007) ISO 281:2007, Rolling bearings — Dynamic load ratings and rating life.

ISO (2013) ISO/TS 14067:2013, Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification and communication.

ISO (2014) ISO 14046:2014, Environmental management – Water footprint – Principles, requirements and guidelines.

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

ISO (2015b) ISO 9001:2015, Quality management systems – Requirements.

ISO (2016a) ISO 21067-1:2016, Packaging – Vocabulary – Part 1: General terms.

ISO (2016b) ISO 14021:2016, Environmental labels and declarations - Self-declared environmental claim (Type II environmental labelling).

ISO (2017) ISO 21930:2017, Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.

ISO (2018) ISO 14024:2018, Environmental labels and declaration – Type I environmental labelling – Principles and procedures.

PEF method (European Commission 2021).

8 VERSION HISTORY OF PCR

VERSION 1.0.0, 2023-05-04

Original version of the PCR.

BEARINGS, BEARING UNITS AND PARTS THEREOF
PRODUCT CATEGORY CLASSIFICATION: UN CPC 4331, 4332 (SUBSET), 4333 (SUBSET)