

MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES

PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

**PCR REGISTRATION NUMBER**

VERSION 1.0, **PUBLICATION DATE**

DRAFT VERSION 1.0 FOR OPEN CONSULTATION. DO NOT USE OR CITE.

VALID TO: 20YY-MM-DD

DRAFT PCR FOR OPEN  
CONSULTATION

## INTRODUCTION TO OPEN CONSULTATION

This draft PCR is available for open consultation until 2021-07-10. Feel free to forward the draft to any other stakeholder you might think is relevant, including colleagues and other organisations.

This is an updated of an existing version of this document. We are therefore interested in comments from stakeholders on:

- General
  - o Alignment with PCRs available in other programmes for type III environmental declarations, industry-specific LCA guides or similar.
- Scope of PCR
  - o Product category definition and description
  - o Classification of product category using CPC codes
- Goal and scope, life cycle inventory and life cycle impact assessment
  - o Functional unit/declared unit
  - o System boundary
  - o Allocation rules
  - o Data quality requirements
  - o Recommended databases for generic data
  - o Impact categories and impact assessment methodology
- Additional information

Comments may sent directly to the PCR Moderator (contact details available in Section 1). There is a template for comments on [www.environdec.com](http://www.environdec.com) that may be used.

For questions about the PCR, please contact the PCR moderator. For general questions about the International EPD® System, EPD or PCR development, please contact the Secretariat via [pcr@environdec.com](mailto:pcr@environdec.com).

## TABLE OF CONTENTS

|     |   |    |
|-----|---|----|
| 1   | Introduction .....  | 4  |
| 2   | General information .....   | 5  |
| 2.1 | Administrative information .....  | 5  |
| 2.2 | Scope of PCR.....   | 6  |
| 3   | PCR review and background information.....                                  | 9  |
| 3.1 | Open consultation .....   | 9  |
| 3.2 | PCR review .....  | 9  |
| 3.3 | Existing PCRs for the product category .....                                | 9  |
| 3.4 | Reasoning for development of PCR.....                                       | 10 |
| 3.5 | Underlying studies used for PCR development.....                            | 10 |
| 4   | Goal and scope, life cycle inventory and life cycle impact assessment ..... | 11 |
| 4.1 | Declared/Functional unit.....   | 11 |
| 4.2 | technical specification, lifespan and Reference service life (RSL) .....    | 12 |
| 4.3 | System boundary .....   | 12 |
| 4.4 | System diagram .....  | 14 |
| 4.5 | Cut-off rules.....  | 15 |
| 4.6 | Allocation rules .....  | 15 |
| 4.7 | Data quality requirements and selection of data .....                       | 16 |
| 4.8 | Environmental performance indicators.....                                   | 21 |
| 4.9 | including multiple products in the same EPD.....                            | 21 |
| 5   | Content and format of EPD.....  | 23 |
| 5.1 | EPD languages .....   | 23 |
| 5.2 | Units and quantities .....  | 23 |
| 5.3 | Use of images in EPD .....  | 24 |
| 5.4 | EPD reporting format.....   | 24 |
| 6   | List of abbreviations.....  | 30 |
| 7   | References.....   | 31 |
| 8   | Version history of PCR .....  | 32 |

# 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<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. 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](http://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.

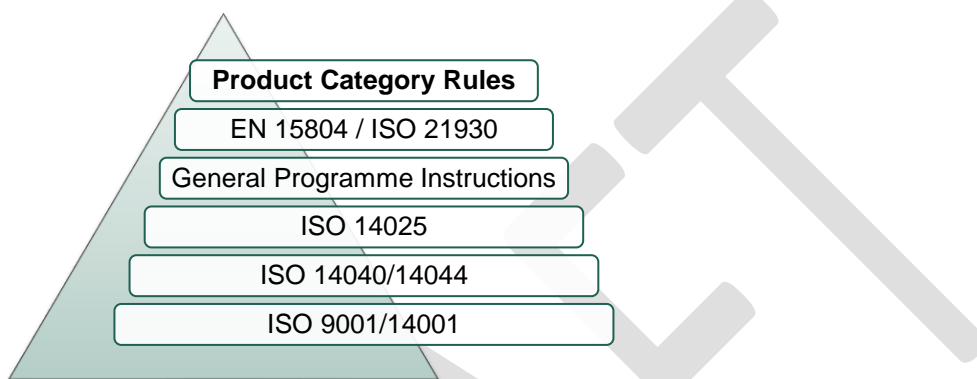


Figure 1 The hierarchy between PCRs, standards and other documents. EN 15804 and ISO 21930 are normative standards for construction products only.

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](http://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.

<sup>1</sup> 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:                                  | MACHINE-TOOLS FOR WORKING MATERIALS  |
| Registration number and version:       | <i>Added by the Secretariat</i>  |
| Programme:                             | <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:info@environdec.com">info@environdec.com</a>  |
| PCR Moderator:                         | Carlo Brondi, CNR-STIIMA, Italy - <a href="mailto:carlo.brondi@stiima.cnr.it">carlo.brondi@stiima.cnr.it</a>   |
| PCR Committee:                         | CNR-STIIMA - The Institute of Intelligent Industrial Technologies and Systems for Advanced Manufacturing - National Research Council of Italy<br><br>TENOVA - Innovative solutions for metals & mining   |
| Date of publication and last revision: | <i>Added by the Secretariat</i>  |
| Valid until:                           | <i>Added by the Secretariat</i>  |
| Schedule for renewal:                  | <p>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.</p> <p>A PCR may be also be updated without prolonging its period of validity, provided significant and well-justified proposals for changes or amendments are presented.</p> <p>See <a href="http://www.environdec.com">www.environdec.com</a> for the latest version of the PCR.</p> <p>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.</p> |
| Standards conformance:                 | <ul style="list-style-type: none"> <li>▪ General Programme Instructions of the International EPD® System, version 3.0, based on ISO 14025 and ISO 14040/14044</li> <li>▪ PCR Basic Module, CPC Division 44 Special-purpose machinery, version 3.02 (CPC 44)</li> <li>▪ ISO 9001, Quality management systems</li> <li>▪ ISO 14001, Environmental management systems</li> <li>▪ ISO 14040, LCA - Principles and procedures</li> <li>▪ ISO 14044, LCA - Requirements and guidelines</li> <li>▪ ISO 14025, Type III environmental declarations</li> </ul>  |

|                  |   |
|------------------|---|
| 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 <a href="http://www.environdec.com">www.environdec.com</a> . 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 Machine-tools for working any material by laser or similar process and the declaration of this performance by an EPD. The product category corresponds to UN CPC Machine-tools for working any material by removal of material, by laser or other light or photon beam, ultra-sonic, electro-discharge, electro-chemical, electron beam, ionic beam or plasma arc processes, water-jet cutting machines.

This category includes any machine tool or machinery and machine-tools for working any material by removal of material, by laser or other light or photon beam, ultra-sonic, electro-discharge, electro-chemical, electron beam, ionic beam or plasma arc processes, water-jet cutting machines.

The hierarchical structure is:

- Division 44 – Special purpose machinery
  - Group 442 Machine-tools and parts and accessories thereof
    - Class 4421 Machine-tools for working metal; machine-tools for working any material by laser or similar process
      - SubClass 44211 - Machine-tools for working any material by removal of material, by laser or other light or photon beam, ultra-sonic, electro-discharge, electro-chemical, electron beam, ionic beam or plasma arc processes, water-jet cutting machines

For more information see <http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=25>

This PCR excludes:

- Agricultural or forestry machinery
- Other special-purpose machinery and parts thereof
- Machinery for metallurgy
- Machinery for mining, quarrying and construction
- Machinery for food, beverage and tobacco processing
- Machinery for textile, apparel and leather production
- Weapons and ammunition
- Domestic appliances

Examples of included special purpose machinery are:

- Machine for laser incision and texturing
- Waterjet machine tools
- Electrochemical Discharge Machine tools for surface finishing
- Laser machines for cuttings

The product group and CPC code shall be specified in the EPD.

MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

The specification of the product should be based on one standard configuration with or without accessories<sup>2</sup>. On the other hand, based on the modular rationalization of milling machines families, the product could be defined as the sum of the structural/functional modules<sup>3</sup> (MOD's) and optional accessories (ACS'). Since machines can be highly customized to different purposes, the EPD shall include specifications of all physical modules, accessories and reconfigurations under declaration.

The contribution to the impact categories that the auxiliary elements generate in adding to those caused by standard configurations, should be reported separately.

The trade name (if relevant), species and the variety (if relevant) of product shall be declared. The production system should be specified, if relevant.

Optionally, in order to enforce information about the product, relevant Type I and Type II environmental labels awarded and recognized at international level to the product may be stated. Any claims made about the product shall be verifiable.

The EPD shall specify the technical performance and other information on the product as reported in Table 1 and Table 2. The information are mandatory any time they are applicable. If similar machines are included in the same EPD, this information shall be specific to each machine independently.

Table 1: Machines description

| INDICATORS                                      | EXAMPLES/EXPLANATIONS/COMPONENTS  |
|---|---|
| Commercial name                                 | <i>As stated in the operating manual and sales catalogues</i>                                   |
| Head  | <i>.....</i>  |
| Size and dimension                              | <i>Length (X Axis), width (Y Axis), height (Z Axis) (mm)</i>                                    |
| Weight  | <i>kg</i>   |
| Maximum load on the table                       | <i>kg</i>   |
| Surface table                                   | <i>mm x mm</i>  |
| Automatic Traverses                             | <i>Longitudinal (mm), cross (mm), vertical (mm)</i>   |
| Type of frame                                   | <i>Bed-type, travelling column, bridge type, rotary table, gantry, high performance gantry</i>  |
| Feeds   | <i>Rapid traverses X-Y-X (m/min)</i>  |
| Installed Power                                 | <i>W</i>  |
| Level of automation                             | <i>Automatic (system, cell, centre), semiautomatic (NC Machine), mechanic (Machine)</i>         |
| Machining (machine process, motion and control) | <i>Voltage, E/R module supply, monitoring module, CNC total, pulse lubrication, linear ways</i> |
| Process conditioning and cooling                | <i>Compressed Air, spindle cooling pump</i>   |
| Workpiece handling                              | <i>Hydraulic pump, cutting fluid jets</i>   |
| Tool handling or die change                     | <i>Automatic tool changer (units), Hydraulic pump</i>   |

<sup>2</sup> Accessories are auxiliary elements. Their incorporation into a standard configuration does not alter the primary function of material removing, just provide secondary operations as tool change, chips removal, etc.. They are equipment that have a significant sale and are included in the sales catalogue of the machines.

<sup>3</sup> Modules are structural elements; some combinations offer the capability of material removing. Each reconfiguration (RECONF) constitutes a standard machine. Therefore, standard machines are defined as configurations provided to customers to remove material.

Table 2: Technical information

| INDICATORS  | EXAMPLES                             |
|---|--------------------------------------|
| Functional performance (energy consumption) under different advances and different configurations | <i>kWh/m<sup>3</sup></i>             |
| Productivity,   | <i>kWh/h</i>                         |
| Processing module power   | <i>kW</i>                            |
| Total power   | <i>kW</i>                            |
| Processing material consumption   | <i>NM/h</i>                          |
| Lubricating oil consumption   | <i>kg/h</i>                          |
| Refrigerating fluid consumption   | <i>kg/h</i>                          |
| Finishing technology  | <i>laser, electro-erosion, other</i> |

## 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

This PCR was available for open consultation from 2021-05-10 until 2021-07-10, 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](http://www.environdec.com).

- *List of stakeholder names and affiliation*

#### 3.2 PCR REVIEW

##### 3.2.1 VERSION 1.0

|                          |  |
|--------------------------|--|
| PCR review panel:        | The Technical Committee of the International EPD® System. A full list of members is available at <a href="http://www.environdec.com">www.environdec.com</a> . The review panel may be contacted via <a href="mailto:info@environdec.com">info@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: | <i>Added by the Secretariat</i>  |
| Review dates:            | <i>Added by the Secretariat</i>  |

#### 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](http://www.environdec.com).
- UL Environment. <https://industries.ul.com/environment/transparency/product-category-rules-pcrs>
- JEMAI CFP Program. <https://www.cfp-japan.jp/english/>
- JEMAI EcoLeaf. <http://www.ecoleaf-jemai.jp/eng/pcr.html>
- KEITI Environmental Declaration of Product. <http://www.epd.or.kr/eng/about/keitInfo.do>
- PEF System - [https://ec.europa.eu/environment/eussd/smgp/ef\\_pilots.htm#pef](https://ec.europa.eu/environment/eussd/smgp/ef_pilots.htm#pef)

No existing PCRs with overlapping scope were identified."

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/<br>STANDARDISATION BODY | REGISTRATION NUMBER, VERSION<br>NUMBER/DATE OF PUBLICATION | SCOPE   |
|---|------------------------------------|--|---|
| Other special-purpose machinery and parts thereof   | Version 3.01                       | 2010:08  | Machines designed for a special-purpose, as defined by the UN CPC group 449 and underlying classes. |
| Machine-tools for drilling, boring or milling metal | Version 3.02                       | 2012:02  | Assessment of the environmental performance of machine tools for drilling, boring or milling metal. |

This PCR consulted in deep both the PCRs listed in Table 1 in order to harmonize reporting on the machinery sector.

### 3.4 REASONING FOR DEVELOPMENT OF PCR

This PCR was developed to enable publication of EPDs for this product category 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:

- Updating of the life cycle assessment study (LCA) of the compact fixed bed milling machine range, NORMA.Martinez E (2017)•
- Energy-Using Product Group Analysis - Lot 5. Machine tools and related machinery. Sustainable Industrial Policy Building on the Ecodesign. Directive - Energy-using Product Group Analysis/2. Dipl.-Ing. Karsten Schischke, Fraunhofer Institute for Reliability and Microintegration, IZM (2012) <http://www.eceee.org/ecodesign/products/machine-tools/>
- ISO 14955-1:2017 Machine tools -- Environmental evaluation of machine tools -- Part 1: Design methodology for energy-efficient machine tools.

## 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

Unit for study can be defined as follows

**Functional Unit** can be defined as range of service that the machine can provide. The functional unit shall include the complete definition of set of provided physical performance for 1 physical unit of the processed material. Such aggregated profile shall be linked with

- A range of corresponding operational set up of machine and working conditions (machine set-up, auxiliary materials used, type of operation, processing time etc.)
- Contextual consumption and emissions for each working condition (that may be derived by a parametrization of consumptions and emissions according to the variation of working parameters)

Such information shall be linked with test campaigns. In addition to such information also sound assumptions on the effective use of the machine during its RSL (Reference Service Life) shall be defined. Such data should be referred to data from final users or, alternatively, to reasonable expected use of the machine. The functional unit aggregates such different information to provide a comprehensive range of service by a specific machine.

Alternatively, a **Declared Unit** can be defined as specific use condition of the working machine. The declared unit shall include the complete definition of a set of physical performance for 1 physical unit of the processed material to be linked with

- A precise operational set up of machine and a specific working conditions (e.g. machine set-up, auxiliary materials used, type of operation, processing time etc.)
- Contextual consumption and emissions for the selected working condition

Such information shall be linked with test campaigns by the company. The choice of the specific Declared Unit shall be extensively justified.

In addition to such information also sound assumptions on the effective use of the machine during its RSL shall be defined. Such data should be associated to a reasonable expected use of the machine in relation to a specific service performance.

|  | Declared unit   | Mandatory | Value                           | Standard Reference |
|--|---|-----------|---------------------------------|--------------------|
| <b>Conditions of processed surface</b> | Physical unit of processed material (linear, surface, volume, etc.) | ✘         | 1m/ 1sqm/ 1m <sup>3</sup> / 1kg | S.I.               |
|  | Material type   | ✘         |                                 | -                  |
|  | Roughness (Ra)  | -         |                                 | BS EN 10049:2005   |
|  | Pick count for centimetre (Rpc)                                     | -         |                                 | BS EN 10049:2005   |
|  | Skew (Rsk)  | -         |                                 | ISO 4287:1997      |
|  | Waviness average amplitude(Wa)                                      | -         |                                 | ISO 4287:1997      |
|  | Average peak to valley height (Rz)                                  | -         |                                 | ISO 4287:1997      |
|  | Rootmean square deviation (Rq)                                      | -         |                                 | ISO 4287:1997      |
|  | Material Ratio (Rmr)  | -         |                                 | ISO 4287:1997      |
|  | Haze  | -         |                                 | ISO 13803          |
|  | DOI   | -         |                                 | ASTM D5767-A       |
|  | Gloss   | -         |                                 | ISO 2813           |
|  | Hardness  | -         |                                 | -                  |
|  | Other   | -         |                                 | N.A.               |
| <b>Operational conditions</b>          | Processing time for physical unit                                   | ✘         |                                 | S.I.               |
|  | Auxiliary materials   | ✘         |                                 | N.A.               |
|  | Machine configurations  | ✘         |                                 | N.A.               |
|  | Consumed power  | -         |                                 | N.A.               |
|  | Geography (Continent)   | ✘         |                                 | N.A.               |
|  | Reference Service Life (RSL)  | ✘         |                                 | N.A.               |

In addition to Declared Unit a further description of machine performance can be provided by the user.

Such operation can be also contextualized with reference to a sequence of operations or to one type of working item (e.g. 1 worked metal item etc.) or alternatively one standard time, (e.g. 1 h of operation), during which operational conditions are still stated.

MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

In order to calculate the impact for the whole machine tool, two aspects should be clarified:

- The expected lifetime production of machine tools (daily hours, annual operating days and total operating years)
- The productivity according to different operational modes.

This information is very much dependent on the production pattern. The use pattern of machine tool applied for calculating the usage scenario shall be included in the EPD

The declared units shall be included in the EPD, as well as the reference flows needed for comparing the upstream phase and the use phase. The declared unit shall be stated in the EPD. The environmental impact shall be given per declared unit. A description of the function of the product should be included in the EPD®, if relevant.

This PCR uses a declared unit instead of a functional unit as all functional and qualitative aspects are not possible to capture in the same unit. These aspects should be taken into consideration when comparing EPDs based on this PCR.

The reference flow is computed according to the declared/functional unit definition.

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

The **Reference Service Life (RSL)** of a product category is the reference time to which the performance of all products of a product category shall be related. A range of use pattern is defined in this PCR, which might be considered as base case in compatibility between claims, 20 h/day x 250 day/year x 30 years= 150 000 h expected lifetime.

## 4.3 SYSTEM BOUNDARY

The scope of this PCR and EPDs based on it is from cradle-to-grave.

The International EPD® System uses an approach where all attributional processes from “cradle to grave” should be included using the principle of “limited loss of information at the final product”. This is especially important in the case of business-to-consumer communication.

### 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 three life-cycle stages above shall be reported separately and in aggregated form. The processes included in the scope of the PCR and belonging to each life cycle stage are described in Sections 4.3.1.1–4.3.1.3.

#### 4.3.1.1. Upstream processes

All relevant unit processes along the upstream supply chain shall be included, for example:

- Extraction and production of raw material for all main parts and components.
- Secondary processing of material for main parts and components.
- Production of commercial products<sup>4</sup> used in the core process.
- Transportation of raw material and commercial products.

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<sup>4</sup> Purchased elements are integrated in the machine and that are not transformed in the core processes.

MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

- The manufacturing of primary and secondary packaging, if relevant.
- Production of electricity and fuels used in the upstream module.

Upstream processes not listed 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. Core processes

All relevant unit processes along the upstream supply chain shall be included, for example:

- External transportation to the core processes (e.g. materials, packaging to the factory).
- External transportation from the core processes (e.g. wastes to the landfills).
- Manufacturing process for main parts and components according to a further specification below (see 4.10.2)
- Internal transports within the manufacturing plant.
- Assembly of the final machine tool
- Waste treatment of waste generated during manufacturing of machine tool
- Operation and maintenance (e.g. of the machines and equipment necessary for machine manufacturing).
- Preparation of the final product.
- Impacts due to the electricity production according the proper energy mix hypotheses.

Core processes not listed may also be included. Manufacturing of a minimum of 99% of the total weight of the declared product including packaging shall be included.

The following processes shall not be included:

- manufacturing of production equipment, buildings and other capital goods,
- business travel of personnel,
- travel to and from work by personnel, and
- research and development activities.

#### 4.3.1.3. Downstream processes

All relevant unit processes shall be included, for example:

- transportation of the product to retailer/consumer,
- Eventual Foundation trenches.
- Lifetime operation of the product including energy and material consumptions and emissions (e.g. machine parts replacements, coolant, ancillary products etc.).
- Maintenance, replacements of machine elements, during RLS (Reference Service Life).
- Revamping activities including substitution of key modules of the machine
- Disassembling of the product.
- EoL state material after use phase and final disassembly.
- End-of-life processes of packaging waste and any wasted part of the product.

## 4.3.2 OTHER BOUNDARY SETTING

### 4.3.2.1. 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.

4.3.2.2. 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 scrapyards/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 scrapyards/collection site shall be included. The material or component going to recycling is then an outflow from the product system.

See Section **Error! Reference source not found.** for further guidance.

4.3.2.3. 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.

4.3.2.4. 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

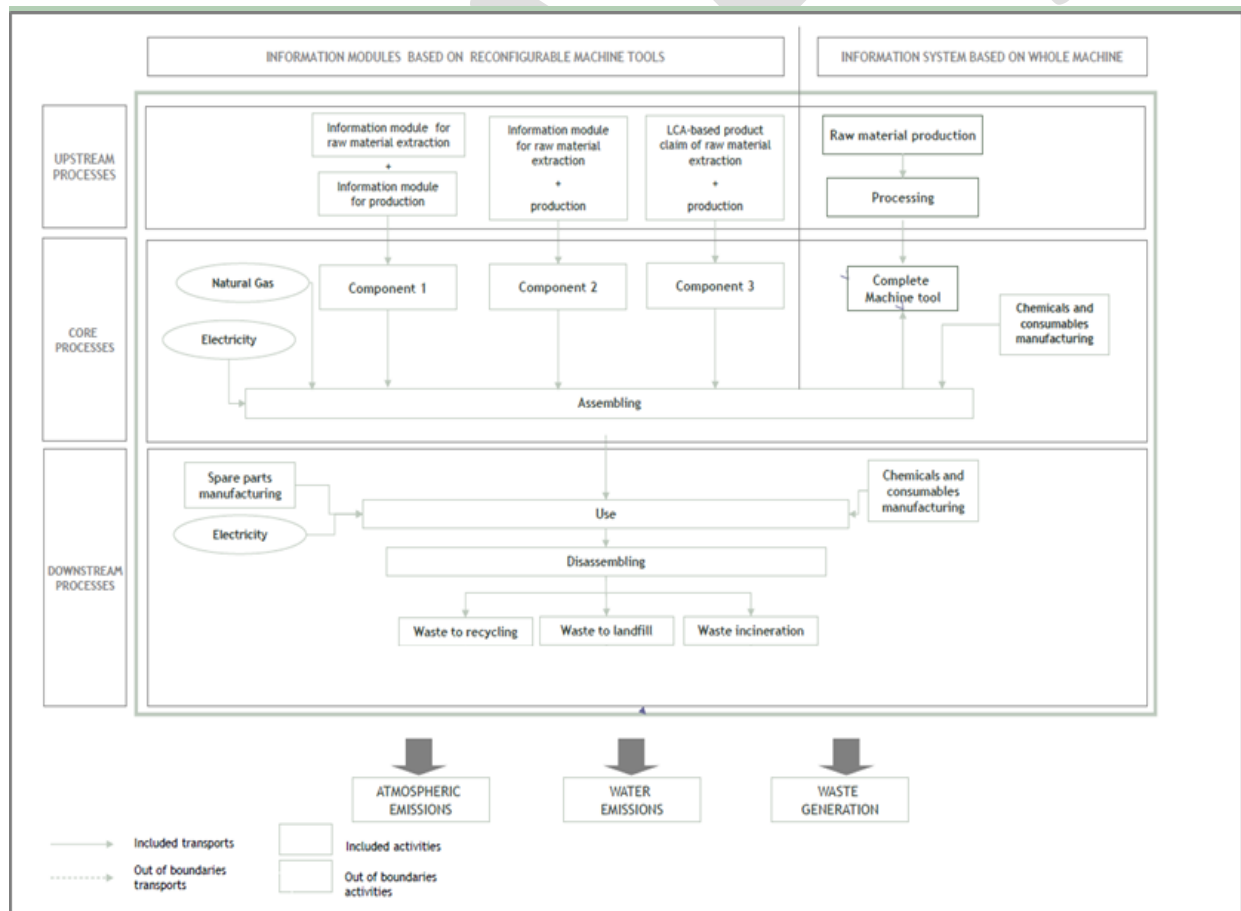


Figure 2 System diagram illustrating the processes that are included in the product system, divided into upstream, core and downstream processes.

Modularity is a key characteristic of different machine tools. Each machine can be configured in a specific model and further changes in its structure can be performed along its lifetime.

capacity and functionality, within a part family, in response to market change. Information modules based on RMT are LCA based information for parts, components and other inputs that are used to manufacture or assembly of machine tools.

## 4.5 CUT-OFF RULES

A cut-off rule of 1% 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 4.3) shall together give rise to at least 99% of the results of any of the environmental impact categories. Also, 99% of the mass of the product content and 99% 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.

## 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.

For key processes in the product system,

| PROCESS                       | MAIN PRODUCT AND CO-PRODUCTS  | ALLOCATION INSTRUCTION           |
|-------------------------------|---|----------------------------------|
| Finishing                     | Processed items   | Surface area (m <sup>2</sup> )   |
| Machining                     | Main parts and components of other equipments                                 | Time of machining (h)            |
| Painting                      | Main parts and components of other equipments                                 | Painted area (m <sup>2</sup> )   |
| Auxiliary energy consumptions | Main parts and components of other equipments                                 | Men-hour (h)                     |
| Valuable waste                | Processing scraps sold as secondary raw material at a specific economic value | Economic Value (Actual Currency) |

Table 2 provides specific allocation guidance.

| PROCESS | MAIN PRODUCT AND CO-PRODUCTS | ALLOCATION INSTRUCTION |
|---------|------------------------------|------------------------|
|---------|------------------------------|------------------------|

|                               |   |                                  |
|-------------------------------|---|----------------------------------|
| Finishing                     | Processed items   | Surface area (m2)                |
| Machining                     | Main parts and components of other equipments                                 | Time of machining (h)            |
| Painting                      | Main parts and components of other equipments                                 | Painted area (m2)                |
| Auxiliary energy consumptions | Main parts and components of other equipments                                 | Men-hour (h)                     |
| Valuable waste                | Processing scraps sold as secondary raw material at a specific economic value | Economic Value (Actual Currency) |

Table 2 General criteria for subdivision of key processes in the product system, if steps 1 and 2 are not possible.

#### 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.

#### 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.



Any data used should preferably represent average values for a specific reference year. However, the way these data are generated could vary, e.g. over time, and in such cases they should have the form of a representative annual average value for a specified reference period. Any deviation should be declared.

#### 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 1% 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 assessed to be better than  $\pm 5\%$ , in terms of the environmental impact calculated on the basis of the data, of data that is 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.

It is recommended to include in the LCA study a data quality table to compare the quality of the data used in the study versus the data quality requirements listed in this PCR. Deviations shall be registered.

The EPD must identify the unit processes represented by generic and specific data not meeting precision, completeness, representativeness criteria given in this PCR.

The EPD may include a data quality declaration to demonstrate the share of specific data, selected generic data and proxy data contributing to the results of the environmental impact indicators.

#### 4.7.2 EXAMPLES OF DATABASES FOR GENERIC DATA

Table 3 lists examples of databases and datasets to be used for generic data. Please note that a data quality assessment shall be performed also for data listed in the table, and that other data that fulfil the data quality requirements may also be used.

| PROCESS  | GEOGRAPHICAL SCOPE | DATASET   | DATABASE  |
|--|--------------------|---|-----------|
| Steel and metal components, unspecified composition        | Global             | market for steel, chromium steel 18/8, hot rolled   steel, chromium steel 18/8, hot rolled   Cutoff, U - GLO  | ecoinvent |
| Unknown chromium steel manufacturing processes             | European           | metal working, average for chromium steel product manufacturing   metal working, average for chromium steel product manufacturing   Cutoff, U - RER | ecoinvent |
| Unknown steel manufacturing processes or single steel item | European           | metal working, average for steel product manufacturing   metal working, average for steel product manufacturing   Cutoff, U - RER                   | ecoinvent |
| Unknown copper manufacturing processes                     | European           | metal working, average for copper product manufacturing   metal working, average for copper product manufacturing   Cutoff, U - RER                 | ecoinvent |
| Unknown metal manufacturing processes                      | European           | metal working, average for metal product manufacturing   metal working, average for metal product manufacturing   Cutoff, U - RER                   | ecoinvent |

|  |          |  |           |
|--|----------|--|-----------|
| Unknown aluminium manufacturing processes                          | European | metal working, average for aluminium product manufacturing   metal working, average for aluminium product manufacturing   Cutoff, U - RER                          | ecoinvent |
| Programmable Logic Controllers and electronics within laser drives | Global   | market for printed wiring board, surface mounted, unspecified, Pb containing   printed wiring board, surface mounted, unspecified, Pb containing   Cutoff, U - GLO | ecoinvent |
| Ethernet cables  | Global   | market for cable, network cable, category 5, without plugs   cable, network cable, category 5, without plugs   Cutoff, U - GLO                                     | ecoinvent |
| Power cables   | Global   | market for cable, three-conductor cable   cable, three-conductor cable   Cutoff, U - GLO   | ecoinvent |
| Cables, unspecified type   | Global   | market for cable, unspecified   cable, unspecified   Cutoff, U - GLO   | ecoinvent |
| Rubber and polymeric items   | Global   | Depending of the polymer type  | Ecoinvent |
| Unknown copper manufacturing processes                             | European | metal working, average for copper product manufacturing   metal working, average for copper product manufacturing   Cutoff, U - RER                                | ecoinvent |
| Unknown metal manufacturing processes                              | European | metal working, average for metal product manufacturing   metal working, average for metal product manufacturing   Cutoff, U - RER                                  | ecoinvent |
| Unknown aluminium manufacturing processes                          | European | metal working, average for aluminium product manufacturing   metal working, average for aluminium product manufacturing   Cutoff, U - RER                          | ecoinvent |

Table 3 Examples of databases and datasets to use for generic data.

In addition, electricity demand in the use phase should be modelled according to the priority indicated by section **Error! Reference source not found.** National residual mixes should be employed if available (e.g. within European countries), otherwise the national mix can be employed.

### 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 an organisation has direct management control shall be specific and collected on site.
- Data referring to contractors that supply main parts, packaging, or main auxiliaries should be requested from the contractor as specific data, as well as infrastructure, where relevant.
- Data on transport of main parts and components along the supply chain to a distribution point (e.g. a stockroom or warehouse) where the final delivery to the manufacturer can take 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 may correspond a national electricity market, if this can be justified.

The mix of electricity used in upstream processes shall be documented in the EPD, where relevant.

- Packaging: specific data shall be used for the consumer packaging production if it is under the direct control of the organization or if the environmental impact related to the consumer packaging production is more than 10% of the total product environmental indicators. In other cases, generic data may be used. When consumer packaging shows the organization's logo, the LCA report should report the exerted/non-exerted direct control on the production of consumer packaging by the organization.

#### 4.7.3.2. Core processes

- Transport from the final delivery point of raw materials, chemicals, main parts, and components (see above regarding upstream processes) to the manufacturing plant/place of service provision should be based on the actual transportation mode, distance from the supplier, and vehicle load, if available.
- Goods: 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.

The processes listed below for the mechanical assembly and electric installation shall be included (where applicable):

- Machining (energy inputs, chemical products and other consumables consumption, water consumption, waste generation and diffuse emissions). Production of machined parts shall be included under upstream processes, as well as, the amount of scraped material.
- Painting (energy inputs, chemical products and other consumables consumption, water consumption, waste generation and diffuse emissions,). Production of painted parts shall be included under upstream processes.
- Mechanical assembly and electric/hydraulic installation (energy inputs, chemical products and other consumables consumption, waste generation). Production of electric/hydraulic component shall be included under upstream process.
- Soldering (energy inputs, chemical products and other consumables consumption and diffuse emissions, transport of chemical products and consumables from immediate supplier to core factory). Production of soldered parts shall be included under upstream processes.
- 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<sup>5</sup>.

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

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 may correspond a national electricity market, if this can be justified.

The mix of electricity used in the core processes shall be documented in the EPD, where relevant.

- Waste treatment processes of manufacturing waste should be based on specific data, if available.

#### 4.7.3.3. Downstream processes

The following requirements apply to the downstream processes:

##### Use stage

- Data for the use stage are usually based on scenarios, but specific data should be used when available and relevant.
- Data on the pollutant 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.
- Experimental data for electricity consumption in the use phase should be based on a use scenario, which shall be defined and declared into EPD.
- Information on the installed power, average power factor, active power (W) of experimental data must be reported in the LCA study as further support to assessment of power consumption.
- Additional processing tools (i.e. laser actuator) and spare/ware parts during its RLS must be included (material & secondary processing) in the LCA scope. Information on planned maintenance over the life time of the machine should be used as the basis.
- The use of water, chemicals and any ancillary material and fluid (e.g. inert gas, electroerosion oil etc.) by the machine during the use phase shall be calculated based on the defined use scenario.
- The number of activity hours has to be declared in LCA and EPD.
- 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. National residual electricity mix or residual mix on the market
  2. National electricity production mix or electricity mix on the market

The mix of electricity used in the downstream processes shall be documented in the EPD, where relevant.

- The transport of the product to the customer shall be described in the reference PCR, which should reflect the actual situation to the best extent possible. The following priority should be used:
  1. Actual transportation distances and types.
  2. Calculated as the average distance of a product of that product type transported by different means of transport modes.
  3. Calculated as a fixed long transport, such as 1 000 km transport by lorry or 10 000 km by ship, according to product type.

##### Revamping

- Machine tools are equipment with a very long lifetime and their elements have a very high sale's potential in the second-hand market. For this reason, it is difficult to define a waste management scenario. A normal practice, due to the high cost that supposes the investment in new capital goods, is the replacement or substitution of the parts of machinery which become obsolete, giving rise to a new reconstruction of the in order to be used afterwards: revamping activity. Revamping activity can include the substitution of major modules, their transportation and dismissal and replacement of new modules with the same or improved features.

##### End of Life

- Scenarios for the end-of-life stage 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.

MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

- Due to the B2B (business to business) characteristics of this product it can be assumed, that the end-of-life machine largely happens under well controlled and state-of-the art conditions. Also, most of the components represent a remarkable intrinsic value due to the scrap metal values, so high down-stream recycling quotas can be anticipated.
- The outstanding part of metal materials is subject to re-use and recycling. Components represent a remarkable intrinsic value due to the scrap metal values, so high down-stream recycling quotas can be anticipated.

Recommendations for source separation and recycling can be given, as well as recommendations for other waste treatment of product parts if relevant.

#### 4.7.4 DATA QUALITY DECLARATION

EPDs may include a declaration of the quality of data used in the LCA calculations.

### 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](http://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.

The alignment/adoption of indicators from the external product category rules does not imply that the EPDs can be claimed to be aligned or compliant with the external product category rules. Alignment/compliant with external product category rules requires alignment/compliant of the entire method applied, and not just the selection of indicators.

### 4.9 INCLUDING MULTIPLE PRODUCTS IN THE SAME EPD

#### 4.9.1 PRODUCTS FROM THE SAME COMPANY

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 included in the same EPD if none of the declared environmental performance indicators differ by more than 10% between any of the included products. The results for the environmental performance indicators of one representative product shall be declared according to Section 5.4.5. The choice of representative product shall be justified in the EPD, using, where applicable, statistical parameters.

#### 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 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.

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MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

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## 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](http://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<sup>6</sup>.

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<sup>3</sup>)
  - 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<sub>2</sub> equivalents.
- Three significant figures<sup>7</sup> 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 26<sup>th</sup>, 2017.
- The result tables shall:

<sup>6</sup> Therefore, results of normalization are not allowed to be reported in the EPD.

<sup>7</sup> 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  $1.2 \cdot 10^2$  and  $1.2 \cdot 10^{-2}$ .

MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

- 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.<sup>8</sup>
- 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](http://www.environdec.com)
- Programme operator: EPD International AB
- Logotype of the International EPD® System
- EPD registration number as issued by the programme operator<sup>9</sup>
- Date of publication (issue): 20XX-YY-ZZ
- Date of revision: 20XX-YY-ZZ, when applicable

<sup>8</sup> This requirement does not intend to give guidance on what indicators are mandated (“shall”) or voluntary.

<sup>9</sup> 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.



MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

- 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](http://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](mailto: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<sup>10</sup> and the PCR in a table with the following format and contents:

|  |
|--|
| Product category rules (PCR): <i>&lt;name, registration number, version and UN CPC code(s)&gt;</i>   |
| PCR review was conducted by: <i>&lt;name and organisation of the review chair, and information on how to contact the chair through the programme operator&gt;</i>  |
| Independent third-party verification of the declaration and data, according to ISO 14025:2006:<br><input type="checkbox"/> EPD process certification <input type="checkbox"/> EPD verification <input type="checkbox"/> Pre-verified tool  |
| <i>In case of certification bodies:</i><br>Accredited by: <i>&lt;name of the accreditation body and accreditation number, if applicable&gt;</i> .<br><br><i>In case of individual verifiers:</i><br><i>&lt;Name, and organisation of the individual verifier. The signature may also be included&gt;</i><br>Approved by: The International EPD® System |
| The procedure for follow-up during EPD validity, as defined in the GPI, involves third-party verifier:<br><input type="checkbox"/> Yes <input type="checkbox"/> No   |

<sup>10</sup> 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.

### 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,
- 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.

This section may also include:

- name and contact information of organisation carrying out the underlying LCA study,
- 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

MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

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),<sup>11</sup> 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);
- 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; and
- Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment Text with EEA relevance (for electrical part)

It is necessary to identify specific chemical preparations applied in the process, and the concentrations of substances present in these preparations according to their material safety data sheets. Whenever necessary, due to lack of specific database, a substance can be represented by a similar one (in molecular or functional structure). The considered substances and their respective concentrations (the upper limit of concentration interval) the must be included in the LCA study and the EPD. Table 5 provides a template to collect the recommended information of chemical preparations applied in the process.

| COMMUNICATED PREPARATION | HAZARD IDENTIFICATION OF THE PREPARATION LISTED ON MSDS | SUBSTANCES AND RISK PHRASES LISTED ON MSDS | SUBSTANCES AND RISK PHRASES OF CONCERNED |
|--------------------------|---|--|--|
|                          |   |  |  |
|                          |   |  |  |
|                          |   |  |  |
|                          |   |  |  |
|                          |   |  |  |

Table 5: Identification and replacement of chemical substance by approximation

Information of very high concern substances (candidate list) if present shall be reported also with regards to the use phase.

#### 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.
- In case pre-consumer or post-consumer materials is used within the machine is necessary to mention the source of information for such data.

<sup>11</sup> The GHS document is available at [www.unece.org](http://www.unece.org).

#### 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).

Final packaging can be the outcome of eco-design processes, or other activities, under direct control of the organisation. The type and function of packaging shall be reported in the EPD. Packaging of machine regards procedure of intermediate disassembly of the machine, transportation and assembly nearby final user facility.

The weight of the packaging per product, and 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

#### 5.4.5.1. Environmental impacts

The EPD shall declare the environmental impact indicators, per declared 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/indicators](http://www.environdec.com/indicators). The source and version of the impact assessment methods and characterisation factors used shall be reported in the EPD.

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 indicators for resource use listed at [www.environdec.com/indicators](http://www.environdec.com/indicators) per declared 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 shall declare the indicators for waste production and output flows as listed at [www.environdec.com/indicators](http://www.environdec.com/indicators) per declared unit, per life-cycle stage and in aggregated form.

### 5.4.6 ADDITIONAL ENVIRONMENTAL INFORMATION

As to the possibility of including similar machines in the same EPD, the LCA study should provide information on the environmental impacts of the total life cycle of each basic reconfiguration (upstream processes + core processes + downstream processes) for each the studied impact categories.

In accordance with the rules for adjustment of the EPD format in case of inclusion of several similar products, the machines tool which differ more than  $\pm 10\%$  can still be included in the same EPD, indicating separately the different environmental performances for each product, e.g. in separate columns in a table. Moreover, if the difference is less than  $\pm 10\%$ , a single value could be chosen for each impact category for all products. A variation range description shall be present in the declaration.

An EPD may declare additional environmentally relevant information not derived from the LCA-based calculations, such as:

- 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,

MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

- 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.

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

This section shall include a list of references, including the General Programme Instructions (including version number), standards and PCR (registration number, name and version). The source and version of the characterisation models and the factors used shall be reported in the EPD.

- The method used to determine the energy consumption in the use phase, as well as the apparatus and instruments used for this purpose.
- The underlying LCA.

#### 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 |
| CO <sub>2</sub> | Carbon dioxide  |
| 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                |
| kg              | kilogram  |
| 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                             |
| SO <sub>2</sub> | Sulphur dioxide   |
| 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.

EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems

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

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

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 (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.

ISO 14955-1:2017 Machine tools -- Environmental evaluation of machine tools -- Part 1: Design methodology for energy-efficient machine tools.

Reconfigurable machine tool: CNC machine for milling, grinding and polishing. Procedia Manufacturing 21 (2018) 221- 227 Koren Y., et al. (1999)

Schischke K, Hohwieler E, Feitscher R, König J, Kreuzschner S, Wilpert P, Nissen N. (2012) Energy-Using Product Group Analysis-Lot 5 Machine tools and related machinery Task 4 Assessment of Base Case. Fraunhofer Institute for Reliability and Microintegration, IZM, Department Environmental and Reliability Engineering, Berlin.

Schischke K, Hohwieler E, Feitscher R, König J, Kreuzschner S, Wilpert P, Nissen NF (2012) Energy-Using Product Group Analysis-Lot 5 Machine tools and related machinery Task 1 Report-Definition. Fraunhofer Institute for Reliability and Microintegration, IZM, Department Environmental and Reliability Engineering, Berlin.

Special-Purpose Machinery version 2.5, dated 2015-12-22 (CPC 44), PCR Basic Module

Updating of the life cycle assessment study (LCA) of the compact fixed bed milling machine range, NORMA. Martínez E (2017)

## 8 VERSION HISTORY OF PCR

### VERSION 1.0, 2021-XX-YY

Version 1.0 of the PCR was published.

DRAFT



MACHINE-TOOLS FOR WORKING MATERIALS BY REMOVAL OF MATERIAL, BY LASER OR SIMILAR PROCESSES  
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

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