PEPecopassport® PROGRAM

PSR

SPECIFIC RULES FOR

Uninterruptible Power Systems (UPS)

PSR-0010-ed2.0-EN 2023 12 08

According to PSR-modele-ed2-EN-2021 11 18

Contents

1. Introduction

This reference document complements and explains the Product Environmental Profile (PEP) Drafting Rules defined by the PEPecopassport® program (PEP-PCR ed.4-EN-2021 09 06), available at www.pep-ecopassport.org).

It sets out the additional requirements applicable to UPS. Compliance with these requirements is necessary to:

- Qualify the environmental performance of these products on an objective and consistent basis,
- Publish PEPs compliant with the PEPecopassport® program and international reference standards.[1]

This reference document was drawn up in compliance with the open, transparent rules of the PEPecopassport® program and with the support of stakeholders and professionals in the UPS market.

This version of the PSR UPS replace the previous version (PSR0010 Ed1.1 EN 2015 10 16), with following main update:

Follow PCR Ed4 requirements instead of Ed3

New definition of the Functional Unit

Addition of extrapolation rules for a product family

Aligned with EU PEFCR UPS V5.3 2020-02

Update default values and product definition

Update the reference flow

	www.pep-ecopassport.org
PSR reference	PSR-0010-ed2.0-EN-2023-12-08
Critical review	The third-party Critical review was carried out by Scientific and Technical Center for Building The declaration of conformity published on 2023 06 01 can be found in the Appendices.
Availability	The Critical review report is available on request from the P.E.P. Association contact@pep-ecopassport.org
Scope of validity	The critical review report and the declaration of conformity remain valid within 5 years or until the PEP Drafting Rules, or the normative reference texts to which they refer, are modified.

[1] ISO 14025, ISO 14040 and ISO 14044 standards

2. Scope

In accordance with the general instructions of the PEPecopassport® program (PEP-General Instructions-ed4.1-EN-2017 10 17) and additional to the PCR, "PRODUCT CATEGORY RULES", (PEP-PCR ed.4-EN-2021 09 06) of the PEPecopassport® environmental product declaration program, this document sets out the specific rules for UPS and defines the product specifications to be adopted by manufacturers in the development of their PRODUCT ENVIRONMENTAL PROFILES (PEPs) particularly with regard to:

- the technology and its type of application,
- the conventional reference service life (RSL) taken into account for the Life Cycle Assessment (LCA),
- the conventional use scenarios to be adopted during the product use phase.

2.1. Description of the product families covered

A UPS is a combination of converters, switches and energy storage devices (such as batteries), constituting a power system for maintaining continuity of load power in case of AC input power failure.

Maintaining the power continuity has a much broader meaning than just an electrical protection against power outages. It also means protecting load from poor quality energy phenomena (e.g. overvoltage, voltage sags) by keeping the power source within specified characteristics.

In consistency with IEC 62040 series, this PSR applies to movable, stationary and fixed uninterruptible power systems that deliver single or polyphase fixed frequency AC output voltage not exceeding 1 000V AC.

The annex B of the IEC 62040-3 standard gives an overview of popular UPS topologies in use (see paragraph 2.2 VFD, VI, VFI). UPS types which are not explicitly defined by the IEC 62040-3 standard (e.g. UPS for specific applications) are not covered by the document and will be further the subject of additional sector-specific rules that will complement this document.

The vast majority of the application areas of UPS are covered by the scope :

- Data centers,
- Industry,
- Services,
- Telecom,
- Medical…

The “emergency lighting power supplies" and "power supply for fire protection systems” are out of this PSR scope.

Remark about the energy storage system

To protect load against outages UPS needs an energy storage system to provide the power to the inverter for the required backup time. Among all possible energy storage system (flywheel, compressed air, etc...) the most commonly used technology is batteries.

We consider UPS with energy storage system when the energy storage system is provided with UPS, it is considered as a constitutive element of the UPS like other components (active components, passive components, circuit boards…) and is thus inside this PSR scope.

We consider UPS without energy storage system when the energy storage system is not provided with the UPS. In this case the energy storage system is out of this PSR scope.

2.2. UPS Topology - Input dependency

2.2.1. General

The input dependency is a set of characters describing to which extent, for operation in normal mode, the load power depends on the quality of the AC input power. The set of characters takes form of either VFD, VI or VFI as described in the following subclauses.

[Source: IEC 62040-3:2021-04 5.3.4.2 and Annex B]

2.2.2. VFD (voltage and frequency dependent)

UPS classified VFD shall protect the load from a complete loss of AC input power. The output of the VFD UPS is dependent on changes in voltage and frequency of the AC input power and is not intended to provide additional voltage corrective functions, such as those arising from the use of tapped transformers.

2.2.3. VI (voltage independent)

UPS classified VI shall protect the load as required for VFD and also from under-voltage applied continuously to the input, and over-voltage applied continuously to the input.

The output voltage of the VI UPS shall remain within declared voltage limits (provided by voltage corrective functions, such as those arising from the use of active and/or passive circuits). The manufacturer shall declare an output voltage tolerance band narrower than the input voltage tolerance band.

NOTE: The energy storage device does not discharge when the AC input power is within the input voltage tolerance band.

2.2.4. VFI (voltage and frequency independent)

UPS classified VFI is independent of AC input power voltage and frequency variations as specified and declared in 5.2 and shall protect the load against adverse effects from such variations without discharging the energy storage device.

3. Product Life Cycle Assessment

3.1. Functional unit and reference flow description

These specific rules are additional to section 2.1 "Functional unit and reference flow description" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

3.1.1. Definition of the functional unit

UPS with energy storage system: To ensure the supply of power without interruption to equipment with load of **100 watts** for a RSL of **1 years**, including a backup time capacity of **5 minutes** during power shortages.

UPS without energy storage system: To ensure the supply of power to remain within specified characteristics to equipment with load of **100 watts** for a RSL of **1 year**.

3.1.2. Definition of the declared unit

UPS with energy storage system: To ensure the supply of power without interruption to equipment with load of [P] watts for a RSL of [X] years, including a backup time capacity of [Y] minutes during power shortages.

UPS without energy storage system: To ensure the supply of power to remain within specified characteristics to equipment with load of [P]watts for a RSL of [X] years.

3.1.3. Reference Flow

All environmental impacts are calculated for the declared unit, then data should be divided by the Factor calculated with below formulas to get functional unit result.

UPS without energy storage system:

$$\frac{Declared\ Unit\ Power\ (W) * Declared\ Unit\ RSL\ (year)}{100\ W * 1\ year} = Factor$$

Example: For a declared unit of 10kW and 10 Years RSL, the functional unit environmental impacts will be equal to declared unit data's divided by 1000 see calculation as follows:

$$Factor = \frac{10\ 000 * 10}{100 * 1} = 1\ 000$$

UPS with energy storage system:

The backup time duration (related to energy storage system size) does not have any incidence on the use stage energy consumption B6 (PCR4 figure 4) and should not be part of the calculation of functional unit for this stage. The energy consumption B6 is dependent of the UPS efficiency and UPS power, we consider that UPS spend negligible time in backup mode during its RSL.

Factor for use stage energy consumption B6:

$$\frac{Declared\ Unit\ Power\ (W) * Declared\ Unit\ RSL\ (year)}{100\ W * 1\ year} = Factor$$

Factor for all other stages (excepted B6 of use stage):

$$\frac{Declared\ Unit\ Power\ (W) * Declared\ Unit\ RSL\ (year) * Declared\ Unit\ Backuptime\ (min)}{100\ W * 1\ year * 5\ min} = Factor$$

Example : For a declared unit of 10kW, 10 Years RSL and 15min of backuptime, the functional unit environmental impacts will be equal to declared unit data's divided by 1000 for B6, and by 3000 for other data, see calculation as follows:

$$Factor\ for\ B6 = \frac{10\ 000 * 10}{100 * 1} = 1\ 000$$

$$Factor\ for\ other\ data = \frac{10\ 000 * 10 * 15}{100 * 1 * 5} = 3\ 000$$

To the declared unit corresponds a reference flow, which includes:

- The packaging of raw materials and components
- The reference product representative of the product range,
- The energy storage system if incorporated inside the UPS,
- The reference product packaging,
- Products or items necessary for the maintenance of the UPS during its use stage which are integrated in the field of the study.

3.2. System boundaries

These specific rules are additional to section 2.2 "System boundaries" of the PCR (PEP-PCR ed.4-EN-2021 09 06), which describes all boundaries per stage of life cycle.

The inputs and outputs related to the production of the materials and components (as listed below) making up the reference product and assembly shall be included in the analysis (cannot be in cut-off parts).

- Transformer, choke, EMC filter (if incorporated inside the UPS)
- Electrolytic capacitor (if incorporated inside the UPS)
- Semi-conductor: IGBT / THYRISTOR, etc…
- Printed circuit board
- Housing, casing
- Fans and / or cooling system
- Switch
- Relay
- Breaker
- Battery (if included inside the UPS)
- Wire, bus bar
- Display
- Plug, terminal
- Fuse

3.3. Cut-off criteria

These specific rules are additional to section 2.3 "Cut-off criteria" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

- Equipment which are not part of the UPS or not necessary for the UPS installation are not to be considered: for instance, external cables, cooling of the room.

3.4. Rules for allocation between co-products

There is no UPS specific rules refer to section 2.4 "Rules for allocation between co-products" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

3.5. Development of scenarios (default scenarios)

3.5.1. General

These specific rules are additional to section 2.5 "Development of scenarios (default scenarios)" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

If the registrant wishes to use specific data, these data will have to be justified in the report. These data, transmitted by the manufacturers, are not necessarily certified but based on evidence on the chain of custody. These supporting documents are the responsibility of the declarant or the supplier or a third party (example of third party: independent certification body) these supporting documents must be available if requested.

For each stage a representative energy mix should be used according to each location, data from national or international association can be used.

System boundaries sub-modules	Default scenarios
A1: Raw material extraction and processing	See 3.2 Reference flow
A2: Transport to the manufacturer	Follow PCR, there is no PSR
A3: Manufacturing	Follow PCR, there is no PSR
A4: Distribution to the place of operation	Follow PCR, there is no PSR
A5: Installation on the place of operation	Follow PCR, there is no PSR
B1: Use or application of the product installed	Non applicable. Module equal to 0
B2: Maintenance	See 5.1.4 Maintenance section
B3: Repair	Non applicable. Module equal to 0
B4: Replacement	Non applicable. Module equal to 0
B5: Restoration	Non applicable. Module equal to 0
B6: Energy requirements during the use stage	See 5.1 Use stage scenario
B7: Water requirements during the use stage	Non applicable. Module equal to 0
C1: Deinstallation	Follow PCR, there is no PSR
C2: Transport to the waste treatment site	Follow PCR, there is no PSR
C3: Treatment of waste in view of its reuse, recovery and/or recycling	Follow PCR, there is no PSR
C4: Disposal	Follow PCR, there is no PSR
D: Benefits and loads beyond the system boundaries	Follow PCR, there is no PSR

3.5.2. Manufacturing scenario

These specific rules are additional to section 2.2.3 "Manufacturing Stage" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

3.5.2.1. Recycled content

The recycled content of raw materials can be justified by supplier data (data sheet or supplier declaration) but cannot be justified by generic data (e.g. industry, unions, ADEME).

In absence of manufacturer information, the recycled content of raw materials shall be 0%.

3.5.2.2. Manufacturing raw material losses

The rates of raw material losses can for example be justified by an internal document from the production plant (e.g.: annual balance sheet mentioning the quantity of material entering and leaving the process).

In absence of manufacturer information, the manufacturing raw material losses should be considered at 5% for polymers and injected plastics, 30% for other of the final product weight.

Factory input/output data of raw material quantity measured on a yearly based is accepted as evidence.

Example: A steel case of 10kg will be considered $weight\ of\ losses = 10 * 0.3 = 3kg$, so 13kg of steel should be consider for the life cycle assessment.

Note: The LCI module used to model the raw material or the component may contain a default scrap rate.

- If the scrap rate included in the LCI module is editable, the defaults above should apply.
- If the scrap rate included in the LCI module is not modifiable:
    - The scrap rate is lower than the default values above: this scrap rate must be entered in the support report and the modeling must, as far as possible, be adapted to take into account the difference in waste generated (hazardous or not dangerous).
    - The scrap rate is higher than the default values above: this scrap rate must be entered in the support report.

3.5.3. Packaging of raw materials and components

In absence of manufacturer information amount of packaging of raw materials and components and their delivery to the manufacturer should be considered at 5% of the final product mass with following repartition:

- Wood (pallet) 50%
- Cardboard 40%
- Plastics (PE bags) 5%
- Plastic Foam (EPS, EPE) 5%

End of life shall be consider as considered in Appendix D table 7 of PEP-PCR–ed4-EN-2021 09 06 with 100km by truck for transportation.

Justification of manufacturing waste shall include toxicity when applicable. Manufacturer can describe the process of waste treatment. Annual factory report can be accepted as evidence for manufacturing waste treatment.

3.5.4. Installation scenario

Installation of UPS does not need specific tools or services, only packaging of the product needs to be eliminated. In absence of manufacturer's information treatment of packaging is considered as follow :

EUROSTAT 2020 – European Union 27 Country

Paper and cardboard : 81.6% recycled (France : 91%)

Plastics : 37.7% recycled (France : 27%)

Wood : 32.4% recycled (France : 7%)

Metal : 75.5% recycled (France : 83%)

100% incineration without energy recovery is considered for the part that is not recycled.

3.5.5. Reference product use scenario

These specific rules are additional to section 2.5.4 "Reference product use scenarios" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

3.5.5.1. Typical reference service life RSL

The minimum reference service life for the UPS are defined as follow:

Output power [W]	**Reference service life RSL** Units: year
Functional Unit	**1**
P≤ 1500 W	5
1500 W< P ≤5000 W	8
5000 W< P ≤10000 W	10
P> 10000W	15

According to 2.5.5 RSL must be reduced to battery lifetime when batteries cannot be replaced.

3.5.5.2. Typical load profile

The input parameters to determine the use stage scenario based on Table I.1 of IEC 62040-3 UPS for the entire RSL:

Output power P [W]	**Proportion of Time spent at specified Proportion of Reference Test Load during RSL**			
	25%	50%	75%	100%
P ≤ 300 W	0,2	0,2	0,3	0,3
300 W < P ≤ 3500 W	0	0,3	0,4	0,3
3500 W< P ≤10000 W	0	0,3	0,4	0,3
P > 10000W	0,25	0,5	0,25	0

Table 2: Typical load profile

Example of Table 2 use: The UPS at 1500W is working 30% of the RSL at 50% load, 40% at 75% load and 30% at 100% load.

3.5.5.3. Energy efficiency calculation

Energy Efficiency (Eff) is determined as specified in Annex J of IEC 62040-3.

In case of a single mode UPS :

Use the energy efficiency of the normal mode to calculate the weighted UPS efficiency of the UPS. The weighted UPS efficiency has to be calculated according to:

$$\text{weighted } \textbf{UPS efficiency} = [t]_{25\%} x Eff_{25\%} + [t]_{50\%} x Eff_{50\%} + [t]_{75\%} x Eff_{\mathbf{75\%}} + [t]_{100\%} x Eff_{100\%}$$

Where : $Eff_{x\%}$ is the efficiency in % at specified Proportion of Reference Test Load, see table 2.

In case of a multimode UPS (for example: VFI UPS working in VFD mode) :When a UPS can be used in multiple normal modes the worst case (based on energy efficiency) shall be declared for environmental impacts.

For other normal modes (as high efficiency), environmental impacts can be declared in additional environmental declaration (see paragraph 4.3).

3.5.5.4. Energy consumption calculation

To calculate the UPS average energy consumption in use phase stage during its RSL, the required input parameters are:

- Weighted energy efficiency of the UPS
- Product RSL [X] years as defined in table 1
- Average output power according to load rate
- Identification of the working mode in case of multimode

Weighted energy consumption = (1 - Weighted energy efficiency) x average output power x product lifetime

3.5.6. Maintenance scenarios

These specific rules are additional to section 2.5.5 "Maintenance scenarios" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

Some UPS may require to be maintained to reach the expected RSL. A non-exhaustive list of typical UPS components to be maintained is:

- Electrolytic capacitors,
- Fans,
- Batteries if incorporated in the UPS,
- PCB.

The amount of each component needed during the RSL of the UPS has to be taken into account in the life cycle assessment, as defined in table 3 below. The manufacturer shall use these default values or provide evidence to use different values.

	Maintenance frequency					
Output power [W]		**DC filtering capacitors**	**AC filtering capacitors**	**Fans**	**Power supply PCB**	**Batteries***
P≤ 1500 W		No maintenance				
1500 W< P ≤5000 W		1	1	1	1	1
5000 W< P ≤10000 W		1	1	2	1	1
P> 10000W		2	2	3	2	2

Table 3: Maintenance frequency table

*this is an example for Valve Regulated Lead-acid battery (VRLA), this value needs to be adjusted regarding technology of the energy storage system, and justification need to be provided in LCA report. When product is designed with not replaceable battery the RSL needs to be reduced to battery lifetime.

Availability of the spare part need to cover the entire product RSL.

When justification based on component lifetime estimation is available manufacturer shall declare real component maintenance in accordance with declared service life.

End-of-life of spare parts need to be considered, in absence of manufacturer information Appendix D table 7 of PCR can be followed.

Example of use of table 3:

- for a UPS with output power > 10000W, the DC capacitor of filtering has to be changed twice in the whole lifespan
- for a 3 years battery lifetime in a UPS < 1500W when the battery replacement is possible, one battery replacement needs to be considered, otherwise the UPS reference service life shall be reduced to 3 years

In absence of manufacturer information, waste of packaging during maintenance follow same rule as installation stage see 3.5.2. and travel of a service operator(defined at 80kg) need to be considered to be 100km (two ways) alone in a vehicle and with “car passenger” selected in LCI dataset.

3.5.7. End-of-life treatment scenarios

These specific rules are additional to section 2.5.6 "End-of-life treatment scenarios" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

The end-of-life treatment of waste could, for example, be justified by a certificate from the company in charge of waste treatment at the plant.

In absence of manufacturer information default values shall be used as follows for batteries. The Batteries Directive defines targets for the recycling efficiencies of batteries and accumulators. Recycling efficiencies address the recycling process only; they do not consider the efficiency of the collection, which is covered by the collection target for portable batteries and accumulators.

According to the Batteries Directive, recycling processes should achieve the recycling efficiencies:

- recycling of 85.7% by average weight of lead-acid batteries and accumulators;
- recycling of 84.3% by average weight of nickel-cadmium batteries and accumulators;
- recycling of 60.1% by average weight of other batteries and accumulators.

Source-: EUROSTAT - Recycling efficiency for lead-acid batteries 2020

The UPS without batteries is a waste electrical and electronic equipment, dataset of WEEE LCI module can be used.

Other parts or accessories are considered as define in 2.5.6, and 100% incineration without energy recovery is consider without information's.

3.5.8. Net benefits and loads beyond the system boundaries stage (Module D)

There is no specific rules, paragraph 3.4.2.6 "Net benefits and loads beyond the system boundaries stage (Module D)" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

3.6. Rules for extrapolation to a homogeneous environmental family

Product specific rules additional to section 2.6 "Rule(s) for extrapolation to a homogeneous environmental family" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

After a documented sensitivity study, it has been proven that the environmental impacts of these systems on A1 to C4 stages are globally proportional to their mass. An extrapolation methodology applicable to all life cycle stages (A1-C4) has been established.

The parameters that impact the module D are-:

- The quantity of recycled content in the raw material used to manufacture the products
- The quantity of losses and waste generated throughout all life cycle and their treatment

These parameters are directly related to the product mass and are not supposed to vary within the same homogeneous environmental family (in accordance with paragraph 2.6).

To develop a valid PEP for a range of UPSs following parameters shall be common to the whole range-:

- RSL
- Number of phase available (single phase, Three Phase, other configuration)
- UPS Topology (see 5.3.4.2 and Annex B of IEC 62040-3)
- UPS configuration (see Annex A of IEC 62040-3)
- Technology of the energy storage system
- Single normal mode or multimode (see 3.3.7 and Annex F of IEC 62040-3)

The reference product chosen is the declared unit, the manufacturer can choose the most appropriate model in the range.

For manufacturing stage, transportation stage and End-of-Life stage indicators are proportional to product mass.

$$Extrapolated\ Unit\ Impacts = Declared\ Unit\ Impacts * \frac{Extrapolated\ Unit\ Product\ Mass}{Declared\ Unit\ Product\ Mass}$$

For installation stage indicators are proportional to packaging mass.

$$Extrapolated\ Unit\ Impacts = Declared\ Unit\ Impacts * \frac{Extrapolated\ Unit\ Packaging\ Mass}{Declared\ Unit\ Packaging\ Mass}$$

For use stage indicators are proportional declared power in [W]. Extrapolation is allowed only when efficiency is homogeneous in the product family, otherwise use stage B6 shall be calculated for each single equipment.

$$Extrapolated\ Unit\ Impacts = Declared\ Unit\ Impacts * \frac{Extrapolated\ Unit\ Power}{Declared\ Unit\ Power}$$

See paragraph 4.3 for declaration of the homogenous environmental family.

When Module D is used for extrapolated units same rules as manufacturing stage base on the product mass with packaging.

3.7. Rule applying to joint environmental declarations

There is no UPS specific rules refer to section 2.7 "Rule(s) applying to joint environmental declarations" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

3.8. Environmental data requirements

There is no UPS specific rules refer to section 2.9 "Environmental data requirements" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

3.9. Environmental impact calculation

Product specific rules additional to section 2.10 "Environmental impact calculation" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

For biogenic carbon storage, both methodology 0/0 and -1/+1 are accepted until the update of environmental database. The methodology used for LCA must be mentioned in the PEP and LCA report.

The version of Environmental database must be mentioned in the PEP and LCA report including EF version number (Environmental Footprint).

To switch from functional unit to declare unit the calculation described in 3.1.3 Reference Flow of this document need to be considered.

4. Drawing up the Product Environmental Profile

4.1. General information

Product specific rules additional to section 4.1 “General information” of the PCR (PEP-PCR ed.4-EN-2021 09 06).

The following data shall be declared in environmental declaration-:

[X] : typical RSL of the UPS in years, The determination of the numbers [X] of years is explained in table 1

[Y] : backup time capacity in minutes, The determination of [Y] backup time is explained in section 6.5

[P] : output power of the UPS in Watts

The function(s) / service(s) provided: **“what”**	to ensure power supply to equipment in case of mains power failure
The magnitude of the function or service: **“how much”**	[P] Watts supply to the equipment for [Y] minutes*
The amount of service provided over RSL: **“how long/ how often”**	[X] years
The expected level of quality: **“how well”**	Refer to UPS topologies defined in IEC 62040-3 Uninterruptible power systems (UPS) Part 3: Method of specifying the performance and test requirements

*Backup time apply only to products provided with incorporated energy storage system.

Identification of the products (declared unit and extrapolated units):

- Model, commercial reference of the reference product and product covered
- Apparent Power in VA
- Number of phase available (single phase, Three Phase, other configuration)
- UPS Topology (see 5.3.4.2 and Annex B of IEC 62040-3)
- UPS configuration (see Annex A of IEC 62040-3)
- Technology of the energy storage system
- Single normal mode or multimode (see 3.3.7 and Annex F of IEC 62040-3)
- Mass of the equipment

Declaration of PEPs by product family:

Level 1 (Product classification): Electric engineering, automation, process control engineering
Level 2 (Category): Power supply
Level 3 (Family): Uninterruptible Power Systems
Level 4 (Solution) :

- UPS - VFD (Off Line)
- UPS - VI (Line Interactive)
- UPS - VFI ≤ 10kW (Online double conversion)
- UPS - VFI > 10kW (Online double conversion)

Declaration of homogenous family shall include needed data that can be described as follows:

Model	Power [W]	Backup time [minute]	UPS efficiency [%]	Packaging Mass [kg]	Product Mass [kg]
UPS-A Declared unit					
UPS-B Extrapolated Unit					
UPS-C Extrapolated Unit					
…					

Both functional unit and declared unit data shall be published in PEP ecopassport xml database.

4.2. Constituent materials

There is no UPS specific rules refer to section 4.2 "Constituent materials" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

4.3. Additional environmental information

Product specific rules additional to section 4.3 "Additional environmental information" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

This section is used to declare better environmental impact for a specific normal mode. For example, A UPS with a weighted efficiency of 95 % in VFI mode, and 98% in VFD mode, environmental impacts will be declared for VFI mode and VFD mode impacts will be presented in the additional environmental declaration.

When the battery technology is different from VRLA detail need to be provided for battery replacement date, and maintenance parameter need to be updated.

4.4. Environmental impacts

There is no UPS specific rules refer to section 4.4 "Environmental impacts" of the PCR (PEP-PCR ed.4-EN-2021 09 06).

5. PEP update rules

Any PEP registered by the PEPecopassport must be updated and re-registered as soon as the declared product changes by more than 5% in its environmental indicators.

6. Appendices

6.1. Glossary

AC	Alternative Current
DC	Direct Current
EMC	Electromagnetic Compatibility
IGBT	Insulated Gate Bipolar Transistor
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
PCB	Printed Circuit Board
PCR	Product Category Rules
PEP	Product Environmental profile
PSR	Product Specific Rules
RSL	Reference Service Life
UPS	Uninterruptible Power Systems
VFD	voltage and frequency dependent
VFI	voltage and frequency independent
VI	voltage independent
VRLA	Valve Regulated Lead-acid
WEEE	Waste electrical and electronic equipment

6.2. Definitions

For the purpose of this document, the following terms and definitions apply.

Uninterruptible Power Systems or UPS: combination of convertors, switches, and energy storage devices (such as batteries) constituting a power system for maintaining continuity of load power in case of AC input power failure. [Source: IEC 62040-3 3.2.1]

Energy storage system: system consisting of single or multiple devices designed to provide power to the UPS inverter for the required stored energy time.

NOTE-: Examples of energy storage devices include but are not limited to battery, double-layer capacitor (“super” or “ultra” capacitor), flywheel and fuel-cell systems.

[Source: IEC 62040-3 3.2.18]

Battery: set of electrochemical cells of the same type so connected as to act together.

[Source: IEC 62040-3 3.2.19]

Flywheel energy storage system: mechanical energy storage device wherein stored kinetic energy can be converted to electrical energy during stored energy mode.

[Source: IEC 62040-3 3.2.22]

UPS Configurations:

Various UPS configurations are used to achieve different degrees of availability of load power and/or to increase output power rating. Annex A of IEC 62040-3 presents the characteristics of typical arrangements in use.

- Basic Single UPS
- Single UPS with Bypass
- Parallel UPS with common bypass
- Parallel UPS with distributed bypass
- Standby redundant UPS
- Basic dual bus UPS
- Standby redundant dual bus UPS

[Source: IEC 62040-3 Annex A]

Technology of the energy storage system:

Describe the kind of energy storage used (Batteries, Fly-wheel…). For batteries, manufacturer needs to provide main composition relevant to assess environmental impact.

6.3. References

The following documents, in whole or in part, are referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Generic Ecopassport PCR: PCR Product Category rule of the PEPecopassport ® Program number PEP-PCR ed.4-EN-2021 09 06

IEC 62040-3 Edition 3.0 2021-04: Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test requirements

6.4. Declaration of conformity

CSTB
le futur en construction

Direction Energie Environnement
Division Environnement

Programme PEP ecopassport®

Attestation de revue critique des « Règles Spécifiques aux ALIMENTATIONS SANS INTERRUPTION (ASI) »

Chargée de revue critique	Charlotte MAROTTE
Document revu	PSR-0010-ed2.0-EN-draft_20230525
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Période de revue	Août 2022 à juin 2023
Référentiels	L'objectif de la revue critique est de vérifier la conformité du document avec les référentiels suivants : - Le programme PEP ecopassport : PCR-ed4-FR-2021 09 06 - Les normes NF EN ISO 14020-2002 et NF EN ISO 14025-2010 ; - Les normes NF EN ISO 14040 et 14044-2006 La revue critique a été conduite selon les principes de la norme ISO 14 071 : 2014 et a suivi la procédure de développement et adoption des PSR – Règles Spécifiques aux Produits (document PEP ecopassport® PEP - AP0017-ed2-FR-2021 11 18).
Conclusion	Le document revu ne comporte pas de non-conformité par rapport aux référentiels. Par conséquent, ce document - Règles Spécifiques aux ALIMENTATIONS SANS INTERRUPTION (ASI)- PSR-0010-ed2-EN 2023 06 01 est conforme aux exigences des référentiels.

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6.5. Example of weighted energy efficiency and average energy consumption calculation

Example for a 160kW UPS, in VFI mode
RSl according to table 1: 15 years
Typical Load profile and time proportion according to table 2

Time Proportion	25%	50%	25%	0%	← From Table 2
Reference Test Load	25%	50%	75%	100%	← From Table 2
Rated Power W	40 000	80 000	120 000	160 000	← UPS Power for each reference test load
Time spent years	3.75	7.5	3.75	0	← RSL / Time proportion
Time spent hours	32 850	65 700	32 850	0	← Years * 365 *24
UPS efficiency	94%	95%	96%	96%	← UPS efficiency for each reference test load
Power Loss W	2 400	4 000	4 800	6 400	← Rated power *(1-efficiency)
Energy consuption kWh	78 840	262 800	157 680	0	← Time spend in h * Power Loss

Average energy consumption in kWh = 78 840 + 262 800 + 157 680 = 499 320 (sum of energy consumption)

Weighted energy efficiency = 94%*0.25 + 95%*0.5 + 96%*0.25 = 95% (efficiency * time proportion)

Average energy consumption in kWh

(Time spent in hours$_{25\%}$ x Power loss in Watt$_{25\%}$ + Time spent in hours$_{50\%}$ x Power loss in Watt$_{50\%}$ + Time spent in hours$_{75\,\%}$ x Power loss in Watt$_{75\,\%}$ + Time spent in hours $_{100\%}$ x Power loss in Watt$_{100\,\%}$)/1000

Average energy efficiency

Time proportion$_{25\%}$ x UPS Efficiency$_{25\%}$ + Time proportion$_{50\%}$ x UPS Efficiency$_{50\%}$ + Time proportion$_{75\%}$ x UPS Efficiency$_{75\%}$ + Time proportion$_{100\,\%}$ x UPS Efficiency$_{100\%}$

6.6. Example of Extrapolation in extrapolation to a homogeneous environmental family

Model	Power [W]	Backup time [minute]	weighted UPS efficiency [%]	Packaging Mass [Kg]	Product Mass [Kg]
Declared Unit	1000	5	98	1	10
Extrapolated Unit 1	500	5	98	0.8	6
Extrapolated Unit 2	2000	10	98	1.2	20

Manufacturing stage, Transportation Stage and end-of-Life Stage:

$$Extrapolated\ Unit\ 1\ Impacts = Declared\ Unit\ Impacts * \frac{6}{10}$$

$$Extrapolated\ Unit\ 2\ Impacts = Declared\ Unit\ Impacts * \frac{20}{10}$$

Installation stage:

$$Extrapolated\ Unit\ 1\ Impacts = Declared\ Unit\ Impacts * \frac{0.8}{1}$$

$$Extrapolated\ Unit\ 2\ Impacts = Declared\ Unit\ Impacts * \frac{1.2}{1}$$

For use stage indicators are proportional declared power in [W]:

$$Extrapolated\ Unit\ 1\ Impacts = Declared\ Unit\ Impacts * \frac{500}{1000}$$

$$Extrapolated\ Unit\ 2\ Impacts = Declared\ Unit\ Impacts * \frac{2000}{1000}$$