PEP ecopassport® PROGRAM

PSR

SPECIFIC RULES FOR THERMODYNAMIC GENERATORS WITH ELECTRIC COMPRESSION FOR SPACE HEATING AND/OR COOLING AND/OR THE PRODUCTION OF DOMESTIC HOT WATER

PSR-0013-ed3.0-EN-2023-06-06
According to PSR-modele-ed2-EN-2021 11 18

Contents

List of the modifications of the present document

Online version 06/06/2023 :

Modified section Ed 1.0 to Ed 2.0	Modification
Introduction	Third party critical review of PSR edition 2.0 carried out by Julie Orgelet from DDemain
§ 3.5.1.2	Clarification on the default scenario to apply for waste generated during manufacturing phase
§ 3.5.4.1.3	Modification of the definition of the power to take into account for the calculation of energy consumption during the use phase, and removal of the paragraph dealing with VRF
§ 3.5.6.2.1	Correction of the 2nd formula relating to the treatment of refrigerants at the end of equipment life in order to be consistent with the formulas given on the quantity of incinerated refrigerant
§ 3.6	Introduction of extrapolation rules for PEPs covering homogeneous environmental families
Modified section Ed 2.0 to Ed 3.0	**Modification**
§ 2.1	Addition of product sub-categories in the product families concerned : “rooftop”, hybrid heat pump, and heat pump dedicated to produce domestic hot water
§ 3.1.2	Addition of the declared units definition
§ 3.5	Addition of rules for the justification of without default scenario values
§ 3.5	Addition of default value for refrigerant quantity made during use phase, depending on the type of equipment
§ 3.5	The breakdown of use phase in sub-paragraphs related to modules B1, B2, B3, B4, B5, B6 and B7
§ 3.5	Addition of formulas to have the energy consumption during use phase for all the product families concerned (specific formulas for hybrid heat pumps and VRF (various refrigerant flow devices)
§ 3.6.6	Modification of the extrapolation rules for use phase and addition of an extrapolation rule for module D
§ 6.3.	Addition of application examples for the extrapolation rules

1. Introduction

This reference document complements and explains the Product Environmental Profile Drafting Rules defined by the PEP ecopassport® program (PEP-PCR-ed4-EN-2021 09 06~~PEP-PCR ed.3-FR-2015 04 02~~), available at www.pep-ecopassport.org.

It defines the additional requirements applicable to thermodynamic generators with electric compression. 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 PEP ecopassport® program and international reference standards.[1]

This reference document was drawn up in compliance with the open, transparent rules of the PEP ecopassport® program with the support of stakeholders and professionals in the thermodynamic generator with electric compression market and the interested parties.

PEP eco PASS PORT®	www.pep-ecopassport.org
PSR reference	PSR-0013-ed3.0-EN-2023-05-09
Critical review	The initial third-party Critical review was carried out by CODDE Department from LCIE Bureau Veritas. The declaration of conformity published on 09/05/2023 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 standards 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 PEP ecopassport® program (PEP-General instructions-4.1-EN-2017 10 17) and additional to the current PCR (PEP-PCR-ed4-EN-2021 09 06), "Product Category Rules of the PEP ecopassport® eco-declaration program, this document sets out the specific rules for thermodynamic generator with electric compression 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 reference lifetime taken into account for the products' Life Cycle Assessment (LCA),
- the conventional use scenarios to be adopted during the product use stage.

The main purpose of these specific rules is to provide manufacturers of thermodynamic generators with electric compression with a common basis for the development of their product life cycle assessments. The various thermodynamic generator with electric compression technologies available are therefore presented.

2.1. Definition of the product families concerned

The product family concerned is designated by the following terminology: thermodynamic generator with electric compression. The current EN 14511-1 standard is used as a reference source to define each device types.
This product family comprises the following devices:

- Heat pumps,
- Hybrid heat pumps[2]
- Air conditioners (without energy recovery function),
- VRF (Variable Refrigerant Flow) units with a distinction between indoor and outdoor units
- Chillers
- Rooftops

These devices can be reversible or not, using air, water, or brine as cold and/or heat sources.
These devices all involve the use of a refrigerant.
For rooftops, cooling and heating functions are provided thanks to thermodynamic cycle.

It's important to draw up a PEP for the indoor unit and another one for the outdoor unit of a VRF system. Both PEP will have to be put together to get the total system impacts.

The PEP and the LCA report must state the product family to which the product covered by the environmental declaration belongs, i.e.: thermodynamic generators with electric compression as well as the

[2] A hybrid heat pump means, according to EN 14511-1 standard, means an encased assembly or assemblies designed as a unit consisting of an electric heat pump, a boiler and a hybrid master controller providing an optimised operation of the heat generators for space heating and possibly water heating.

sub-category to which it belongs (heat pumps, air conditioners, chillers). According to the category to which the product covered by the declaration belongs, the technical characteristics presented in the following table must be given:

Product sub-category	Characteristics to be declared
Heat pumps	- Technology: Water/water or air/water or air/air or water/air or ground/water - Reversible/Non-reversible - With/Without production of domestic hot water/Dedicated to the production of domestic hot water - Heating and/or cooling capacity - SCOP and/or SEER - Refrigerant used - Refill threshold
Hybrid heat pumps	- Technology: water/air - Reversible/Non-reversible - With/ without production of domestic hot water - Heating and/or cooling capacity - SCOP and/or SEER - Refrigerant used - Refill threshold - Hydraulic backup type and its function (heating only or combined mode)
Air conditioners	- Technology: Air/air or water/air - Reversible/Non-reversible - With/without production of domestic hot water - Indoor unit types - Heating and/or cooling capacity - SCOP and/or SEER - Refrigerant used - Refill threshold - VRF : P_{input} indoor unit
VRF indoor unit / **VRF outdoor unit**	- Technology: Air/air - Reversible/Non-reversible - Heating and/or cooling capacity - SCOP and/or SEER - Refrigerant used - Refill threshold
Chillers	- Technology: Water/water or air/water - Reversible/Non-reversible - Heating and/or cooling capacity - SCOP and/or SEER - Refrigerant used - Refill threshold
Rooftops	- Technology : air/air or water/air - Reversible/non-reversible - Heating and/or cooling capacity - SCOP and/or SEER - Refrigerant used - Refill threshold

Table 1. Characteristics to report according to the products sub-category

2.2. Special case of other types of heat pump

For ground/ground heat pumps and units operating simultaneously with heat and cold, the rules to be applied are those defined in the sections of the present document, except the rules for energy consumption in the usage phase. These latter rules are defined by harmonised calculation methods. They will be specified when the present PSR is updated.

2.3. Consideration of the functions and technologies not included in this document

The specific rules for thermodynamic generators with electric compression will take into account all technological advances not included in this document, provided that such advances form part of a request to include them in the specific rules for thermodynamic generators with electric compression in the PEP ecopassport® Program; the P.E.P. Association will then decide whether the new technology can be included and whether the performance claims are justified.

For heat pumps dedicated solely to the production of domestic hot water, but characterised in heating (according to 813/2013 Regulation) because the hot water tank is separately placed on the market, at the building scale, a PEP must be drawn up for the heat pump and another one for the tank (according to the current PSR-0016 relating to Storage Tanks)
Domestic hot water consumption is given in the current PSR. If the heat pump is dedicated solely to domestic hot water production and characterised in domestic hot water with its tank (according to 814/2013 regulation, the PSR0004 applies.

For hybrid heat pumps, please refer to the current PSR concerning the heat pump part and the energetic consumption of the hydraulic backup type, and the PSR-0012 for other hydraulic backup type components.

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 current PCR (PEP-PCR-ed4-EN-2021 09 06).

3.1.1. Functional unit

The functional unit is determined on the basis of the main technical characteristics of thermodynamic generators with electric compression family.

The common function of all the products grouped in the present PSR is the production of cooling and/or heat.
The unit used to quantify product performance with regard to its cold production function is ***cooling capacity.***
The unit used to quantify product performance with regard to its heat production function is ***heating capacity.***

The functional unit is defined below:

- For reversible devices with heat and cold production:
  - Use in heating and cooling mode:

"To produce 1 kW of heating or 1 kW of cooling according to the appropriate usage scenario defined in the EN 14825[2] standard and during the XX-year reference lifetime of the product."

  - Use in triple service (heating and cooling, as well as domestic hot water production):

"To produce 1 kW of heating or 1 kW of cooling and produce domestic hot water, according to the reference usage scenario and during the XX-year reference lifetime of the product."

- For non-reversible devices with heat (or cold) production:
  - Use in heating mode only:

"To produce 1 kW of heating, according to the appropriate usage scenario defined in the EN 14825 standard and during the XX-year reference lifetime of the product."

  - Use in cooling mode only:

"To produce 1 kW of cooling, according to the appropriate usage scenario defined in the EN 14825 standard and during the XX-year reference lifetime of the product."

  - Use in combined mode (heating only and domestic hot water production):

[2] See the sources used in Section 6.2 of the present document.

"To produce 1 kW of heating and produce domestic hot water, according to the reference usage scenario and during the XX-year reference lifetime of the product."

- Use in domestic hot water production only:

"To produce 1 kW of heating for domestic hot water production, according to the reference usage scenario and during the XX-year reference lifetime of the product."

The reference lifetime of the device (XX years) must be specified in the description of the functional unit as indicated in Section 3.1.3, "Reference product and description of the reference flow".

For the systems for which there is a split between the outdoor unit and the indoor unit, the functional unit of the indoor unit is defined as follows:
"To transmit 1kW of heating or cooling, according to the reference usage scenario and during the XXX-year reference lifetime of the product."

VRF specific case:
VRF systems are covered by 2 PEP: 1 for "outdoor unit" family, and 1 for the indoor unit family compatible with the mentioned outdoor unit family. Both PEP will have to be put together to make a modelling at the building scale.

3.1.2. Declared unit

Declared unit can be used as complementary information in order to help future PEP users.
For France scope, the declared unit must be applied if no functional unit can be defined.

Declared unit is defined below:

- For reversible devices with heat and cold production:
  - Use in heating and cooling mode:

"To produce heating or cooling thanks to (product concerned sub-category) of XX kW (heating capacity) according to the appropriate usage scenario and during the XX-year reference lifetime of the product."

  - Use in triple service (heating and cooling, as well as domestic hot water production):

"To produce heating or cooling and domestic hot water thanks to (product concerned sub-category) of XX kW according to the reference usage scenario and during the XX-year reference lifetime of the product."

- For non-reversible devices with heat (or cold) production:
  - Use in heating mode only:

"To produce heating thanks to (product concerned sub-category) of XX kW (heating capacity) according to the appropriate usage scenario and during the XX-year reference lifetime of the product."

  - Use in cooling mode only:

"To produce cooling thanks to (product concerned sub-category) of XX (cooling capacity) according to the appropriate usage scenario and during the XX-year reference lifetime of the product."

- Use in combined mode (heating only and domestic hot water production):
  "To produce heating and domestic hot water thanks to (product concerned sub-category) of XX (cooling capacity) according to the reference usage scenario and during the XX-year reference lifetime of the product."

- Use in domestic hot water production only:
  "To produce domestic hot water with (product concerned sub-category) of xx kW (heating capacity) for a reference lifetime of XX-year of the product"

The product sub-category mentioned and power (xx kW) have to be adjusted according to the reference product.
The reference lifetime device (XX years) must be specified in the declared unit declaration as explained in the section 3.1.3. "Reference product and reference flow description".

3.1.3. Reference product and reference flow description

For each of equipment categories defined, the analysis carried out includes the following reference flows:

- a thermodynamic generator with electric compression with a specific reference lifetime
- its packaging
- any products or components required for installation.

The chosen study duration, characterising the reference lifetime of the equipment, is:

Product	**Reference lifetime (RLT) in years**	
	Individual residential	**Collective residential / Commercial**
Air conditioner	17 years	22 years
VRF unit (Indoor/outdoor unit)	17 years	22 years
Heat pump (included hybrid heat pumps)	17 years	22 years
Chiller	Not applicable	22 years
Rooftop	Not applicable	22 years

Table 2. Reference lifetime according to the product and the building type

For multisplit devices, it's not possible to separate the outdoor unit and indoor units in several PEPs as well as the VRF. The product reference configuration is the one defined by the EN 14825 standard.

In the context of a PEP for a range of products, extrapolation rules will apply to all the reference products, as described in section 3.6 "Rules for extrapolation to a homogeneous environmental family".

The product selected from the range, which will be used as the reference product, will be the product with the most unfavourable characteristics (all possible functions or options). This choice must be described and justified in the LCA report.

The specific rules do not define any selection criteria concerning the power of the equipment.

3.2. System boundaries

These rules are additional to the section 2.2. "System boundaries" of the current PCR (PEP-PCR-ed4-EN-2021 09 06) which describes boundaries for each life cycle step.

3.2.1. Manufacturing stage

All components supplied with the product and contributing to its proper operation must be included in the scope of the study.

In the case of combined systems and when the production of domestic hot water is accumulated, the storage tank must be taken into account in the scope of the study.

For this stage, refrigerant production must be included in the scope of the study.

3.2.2. Distribution stage

For this stage, the rules defined in the current PCR (PEP-PCR-ed4-EN-2021 09 06) apply.

3.2.3. Installation stage

Conventionally, the installation of thermodynamic generators involves:

- The manufacture and treatments of components of the equipment that are necessary for its operation but are not added until the time of its installation.
- The processes and energy sources implemented at the time of installation.
  The flows related to the installation procedure may be, when necessary for the proper operation of the equipment in its installation location:
  - The installation of a concrete slab
  - Transportation by lifting machines on site
  - The energy consumed during a test phase in the actual service location

The energy flows related to the use of portable hand tools can be neglected.

- The treatment of packaging waste. The packaging waste produced during the installation phase should be disposed of by the installer once the equipment has been installed.

The installation phase can include:

- Modifications to the structure (e.g. masonry work, connection to the electrical network).

Any modification to the structure and/or addition of elements not anticipated by the manufacturer is excluded from the scope of the study. The real impact of these operations must be calculated by the user of the declaration if desired according to the installation elements used during the worksite phase.

Transport distances required to product implementation (concrete slab, lifting machines) are by default 100 km.

The procedures, components, and energies counted in the installation phase shall be described and justified in the LCA report and must be specified in the PEP.

3.2.4. Use stage

According to the breakdown of module B, as defined in section 2.2.6. of the current PCR (PEP-PCR-ed4-EN-2021 09 06), use stage environmental impacts must be split in the following way for all product families concerned by the PSR

B1 : Use phase	Refrigerant emission Waste of condensate-type liquids
B2 : Maintenance	Maintenance operations and refrigerants refill operations and retrieved refrigerants treatment during maintenance operations
B3 : Repair	Not applicable. Module equal to 0.
B4 : Replacement	Not applicable. Module equal to 0.
B5 : Rehabilitation	Not applicable. Module equal to 0.
B6 : Energy consumption during use phase	Electric energy and fossil fuel consumption (if applicable) by applying using scenario as defined in the current PSR
B7 : Water consumption during use phase	If necessary, water consumption and its treatment (domestic water consumption excluded), and condensates

For information, the breakdown of module B is mandatory in France.

3.2.5. End-of-life stage

For this stage, the rules defined in the current PCR (PEP-PCR-ed4-EN-2021 09 06) apply.

Moreover, at this step, the refrigerant end of life treatment must be included in the scope of the study.

3.2.6. Benefits and loads beyond the system boundaries

For this stage, the rules defined in the current PCR (PEP-PCR-ed4-EN-2021 09 06) apply.

For information, module D declaration is mandatory for products placed on the French market and planned to be used on a building LCA.

3.2.7. Consideration of refrigerants in all stages of the life cycle

When applicable, each stage of the life cycle must take the refrigerants into consideration, i.e.:

- Refrigerants: production and transportation upstream, their emission into the air and end-of-life treatment.
- Machine oils: production and transportation upstream, and end-of-life treatment.
- Water and any associated additional treatments (e.g. brine): water consumption and associated treatments.

3.3. Cut-off criteria

The specific rules specified in section 2.3. "Cut-off criteria" of the current PCR (PEP-PCR-ed4-EN-2021 09 06) apply.

3.4. Rules for allocation between co-products

These rules specified in section 2.4. "Rules for allocation between co-products" of the current PCR (PEP-PCR-ed4-EN-2021 09 06) apply.

3.5. Development of scenarios (default scenarios)

These specific rules are additional to the section 2.5. "Development of scenarios (default scenarios)" of the PCR (PEP-PCR-ed4-EN-2021 09 06).

Each modification concerning default scenarios defined below must be justified in the LCA report and mentioned in the PEP.

Accepted evidences in order to modify default scenarios

The current PSR has hypothesis and default scenarios. If the declarant wants to use specific data, this data must be justified in the LCA report. This data, given by industrials, doesn't have to be certified but based on evidence. This evidence is engaging the declarant, supplier, or third-party responsibility. This evidence will have to be available if claimed.

Recycled content of raw materials (see paragraph 3.5.1. "Manufacturing stage") can be justified with suppliers' data but can't be justified with common data (professional associations, ADEME, industries). If there is no justified and specific recycled content, the default data given in section 3.5.1.1. has to be taken.

Raw materials loss rate (see paragraph 3.5.1. “Manufacturing stage”) can be justified with an internal document from the production plant. If there is no specific justified rate, the default data given in section 3.5.1.4. has to be taken.

End of life waste treatment (see paragraphs “3.5.1. Manufacturing stage”, “3.5.3. Installation stage”, “3.5.6. End of life stage") can be justified with an attestation of the waste treatment company. If there is no specific data or default data for installation stage et end-of-life stage, table 7 of appendix D (PEP-PCR-ed4-EN-2021 09 06) applies.

Refrigerant leakage rate (**see paragraph 3.5.1. “Manufacturing stage”, 3.5.4. “Use stage”)** can be justified with a measurement campaign presentation.

3.5.1. Manufacturing stage

A thermodynamic generator with electric compression is made of components supplied by the manufacturer:

- components directly made by the manufacturer
- or components ready to be fitted together.

The rules defined in section 3.8.1. "Requirements concerning the collection of primary and secondary data" of these specific rules apply.

3.5.1.1. Recycled content of raw materials

If there is no justified specific data on recycled content, 0% recycled content must be applied.

3.5.1.2. Momentary leakage of refrigerants during manufacturing stage

Momentary leaks of refrigerants into the air during the production stage (E_{fp}) are equal to the initial refrigerant fill of the product when placed on the market C_n multiplied by the average leakage rate from the assembly site (T_{fp}) thus:

$$E_{fp} = C_n \times T_{fp}$$

T_{fp} the average rate of leakage from assembly site determined in accordance with the "solvent management plan" or the "risk prevention plan". The average rate used must be stated and justified in the LCA report. If no justification is given, 2% shall be used as the average rate.

3.5.1.3. Raw materials packaging and components

Raw materials packaging, their components and their transports to manufacturing sites must be taken into account. Suppliers' data must be used. If no justification is given, an average packaging rate of 5% of the reference equipment mass (equipment + packaging) as defined below, must be taken:
- Wood 50%
- Cardboard 40%
- Low-density polyethylene 10%

Loss materials of these packaging have to be taken into account with an average rate of 5%.
Reused packaging on site are not taken into consideration.
Packaging end of life treatment is modeling as defined in the paragraph 3.5.3.2. of the current PSR.

3.5.1.4. Waste generated during the manufacturing stage

Waste generation (material) and treatment are included in the manufacturing stage.

Manufacturers can dispose of manufacturing waste themselves or arrange for it to be disposed of. The LCA report shall specify how the manufacturer, or any person working for him or on his behalf fulfils the requirements of these stages, by distinguishing between hazardous manufacturing waste and non-hazardous manufacturing waste and providing evidence of such claims.

Where known, the treatment processes (reuse, recycling, energy recovery, landfill, incineration without energy recovery) must be presented and justified in the LCA report, and the associated environmental impacts must be taken into account as indicated in the section 2.5.6. "Product end-of-life treatment scenarios" of the PCR in force (PEP-PCR-ed4-EN-2021 09 06).

The justification for the treatment processes must then be accompanied in the LCA report by the justification for the treatment systems and the recovery rate for each type of waste (e.g. via an annual report on the end-of-life processing of equipment by an eco-organisation).

When the manufacturer does not provide evidence of the processes used to treat the waste generated during the manufacturing stage of the device concerned, the treatment process shall be calculated by default as follows:

- For non-hazardous waste generated by raw material and components:
  The amount of waste is calculated by multiplying the material quantity of the total product (finished product and associated packaging) by 0,05 for plastic injection processes and elastomer, and 0,3 for other manufacture processes. Non-hazardous waste treatment is modelling as follows: 100% of incinerated waste (without waste-to-energy recovery)
- For hazardous waste generated by raw material and components:
  The amount of waste is calculated by multiplying the material quantity of the total product (finished product and associated packaging) by 0,05 for plastic injection processes and elastomer, and 0,3 for other manufacture processes. Hazardous waste treatment is modelling as follows: 100% of incinerated waste (without waste-to-energy recovery)

If applicable, when the worst performer value is used by default, no waste-to-energy recovery will be taken into account. The production of this lost material must be taken into account.

The table below sums up default loss rate for each constituent material of the total product (finished product and associated packaging(s))

Process	Default loss rate	Material mass after manufacture	Material mass to take into account (including loss)
Plastic injection and elastomer	5%	1kg	1,05kg
Other processes	30%	1kg	1,30kg

Table 1 : Default loss rate for each constituent material of the total product (finished product and associated packaging(s))

Application examples of the default scenario:

If 1 kg of a bare product (final mass of the part including packaging) is composed of 0.8kg of steel and 0.2kg of electronic card:

- For non-hazardous waste:

Waste mass = steel mass x 0.3 = 0.8 kg x 0.3 = 0.24 kg of incinerated waste (without waste-to-energy recovery)

- For hazardous waste (0.2 kg of electronic card) :

Waste mass = electronic card mass x 0.3 = 0.2 kg x 0.3 = 0.06 kg of incinerated waste (without waste-to-energy recovery)

Any other waste treatment during manufacture stage which is taken into account for calculation has to be justified on the LCA report and mentioned in the PEP.

By sector-based agreement, the transport stage for this waste shall be taken into account, assuming that it is trucked over a distance of 100 km.

3.5.2. Distribution stage (module A4)

The distribution stage must be analysed in accordance with the section 2.5.3. on " Transport scenarios" of the PCR (PEP-PCR-ed4-EN-2021 09 06) in force.

This stage does not consider any specific treatment for refrigerants.

3.5.3. Installation stage (module A5)

The installation phase includes any process, component, energy or consumption and/or emission required to install a thermodynamic generator with electric compression.

3.5.3.1. Momentary leakage of refrigerants during installation stage

Let C_i be the quantity of refrigerant added to the machine during installation. We consider that in accordance with regulation 1516/2007, all necessary measures were taken to avoid momentary emissions. Thus refrigerant leaks during the installation stage E_{fi} are considered as zero.

3.5.3.2. Waste generated during the installation phase

The end of life of the packaging, whose production was taken into account during the manufacturing stage, is taken into account during the installation stage.
The packaging waste from produced during the installation stage is classed as non-hazardous waste and, in principle, shall be disposed of by the installer once the equipment has been installed.

If there is no specific end of life evidence, treatment scenarios showed in the table below are applies by default. Tables below are representative of year 2019. It's possible to use Eurostat recent consolidated data if they are available. The reference year or used data shall be mentioned in the PEP.

For France scope, the default values below shall be used :

	Recycling rate	Incineration with energy production	Incineration without energy production	Burial rate
Metal	83%	1%	0%	16%
Steel	88%	0%	0%	12%
Aluminium	60%	7%	0%	33%
Paper-Cardboard	91%	5%	0%	4%
Wood	7%	31%	0%	62%
Plastic	27%	43%	0%	30%

Table 1. End of life packaging treatment default scenarios for France scope

For Europe scope, the default values below shall be used :

	Recycling rate	Incineration with energy production	Incineration without energy production	Burial rate
Metal	77%	2%	0%	21%
Paper-Cardboard	82%	9%	0%	9%
Wood	31%	31%	0%	38%
Plastic	41%	37%	0%	22%

Table 2. End of life packaging treatment default scenarios for Europe scope

For other scopes, waste shall be treated according to waste treatment default scenario of the current PCR (PEP-PCR-ed4-EN-2021 09 06) in paragraph 2.5.6.

By sector-based agreement, the transport stage for this waste shall be taken into account, assuming that it is trucked over a distance of 100 km.

Plastic film, straps, packing notes, labels or any other paper on or inside the package are considered to be insignificant and will not be included in the life cycle assessment for packaging waste if these items represent in total less than 10% of the total mass of the packaging.

3.5.4. Use stage (modules B1-B7)

This section does not apply to the types of heat pump mentioned in Section 2.2.

3.5.4.1. Consideration of liquid waste (module B1)

The consideration of liquid waste condensate-type being pure water (except some dirts), there is no treatment modelling to take into account. There is no waste production to model.

3.5.4.2. Consideration of refrigerants during use phase (module B1 and B2)

In the use stage, the following aspects relating to refrigerants will be taken into account:

- Momentary refrigerant leaks,
- Refilling the equipment with refrigerant,
- The treatment of refrigerants recovered after refilling the equipment.

3.5.4.2.1. Momentary leakage of refrigerants (module B1 and B2)

If a specific value is used for the average annual rate of leakage during the use stage (T_{fu}), we will consider that momentary refrigerant leaks during the use phase (Efu) is equal to the total refrigerant charge of the equipment in operation Ct multiplied by T_{fu} multiplied by the reference service life (DVR) thus :

$$E_{fu} = C_t \times T_{fu} \times DVR$$

The use of a specific data shall be justified and explained in the LCA report and mentioned in the PEP.
In other cases, following default data shall be used with the following formula:

$$E_{fu} = Q_{fu} * DVR$$

with (Q_{fu}) the amount of annual fugitive emissions defined in the table below:

Hermetically sealed equipment	Non-hermetically sealed equipment
3g/year	5g/year/removable coupling

Table 6. Amount of annual fugitive emission according to the device type

The term “equipment” can be used for indoor unit or outdoor unit.

Hermetically sealed equipment is defined at the article 2 – definition 11 of F-Gas Regulation 517/2014. The equipment which is not concerned by this definition correspond to non-hermetically sealed equipment.

For VRF:
- Fugitive emission are evaluated on the amount of preloaded fluid into the outdoor unit, the amount of refrigerant brought on site have to be considered at the building level.
- momentary leakages are counted in the outdoor unit.

By default, we will take the number of indoor units, as precised in the EN 14825 standard.
For hermetically sealed equipment, there must be a justification. Example: ERP CH35, EN 378, etc.

Application examples for default data:

Example 1: A monobloc system
- Total number of units: 1 unit
- Total number of fittings: 0
- Annual leakage rate = 1 (total number of units) * 3 = 3g

Example 2: A split system with 1 indoor unit and 1 outdoor unit
The picture below illustrates the system

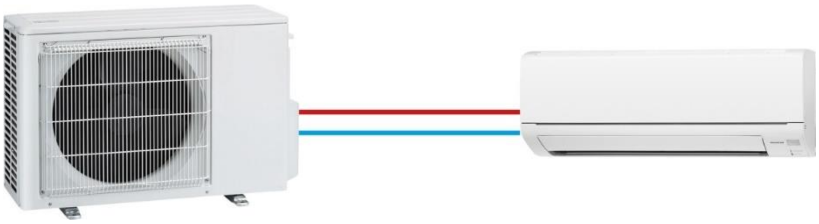

Image 1. Split system {1 outdoor unit / 1 indoor unit} with fittings

- Total number of units: 2 units
- Total number of fittings: 4*1 (number of indoor units) = 4 fittings
- Annual leakage rate = 2 (total number of units) * 3g + 4 (total number of fittings) * 5g = 26g

Example 3 : A VRF system with 1 outdoor unit and 4 indoor units
- Total number of units: 5 units
- Total number of fittings = 4 * 4 (number of indoor units) = 16 fittings
- Leakage rate = 5 (total number of units) * 3g + 16 (total number of fittings) * 5g = 95g

3.5.4.2.2. Refilling the equipment with refrigerant (module B2)

Counting the impacts related to refilling (partially or totally according to the nature of the refrigerant) the equipment includes the production of the new refrigerant to be inserted. The impacts associated with the operator's travel to refill the equipment are not taken into consideration (because they are already included in the classic maintenance trips described in Section 3.5.4.2. "Maintenance stage").

The refill threshold (S_r) is the ratio of refrigerant (expressed in %) below which we consider that the equipment can no longer operate properly.
By default, the refill threshold to be considered is 90% of the total load, whatever the equipment type.
If the refill threshold value used to analyse the reference product life cycle is different from what is specified above for the category of product, it is necessary to:
- Justify and document the new refill threshold used in the LCA report,
- Indicate this in the PEP.

The number of refills, N, is calculated as follows:

$$N = \text{ENT SUP [RLT / n] with } n = 1 + \frac{1 - S_r}{T_{fu}}$$

According to the number of refills, the production of new refrigerant to be inserted is:

- In case of partial refill:

$$N \times (1\text{-}S_r) \times C_t$$

- In case of total refill:

$$N \times Ct$$

- In case of replacements with the recovered refrigerant and top-ups:

$$N \times Ct \times (1\text{-}(\varepsilon_r \times S_r))$$

The recovery efficiency ε_r does not vary according to the type of refrigerant. It is set to 90% by default.

The type of refill (partial or total) must be justified in the LCA report.

3.5.4.2.3. Treatment of refrigerants recovered after refills (module B2)

The treatment of refrigerants after recovery on the working site includes:

1. Collection of refrigerant (transport),
2. Treatment of refrigerant
    2.1 Incineration without energy recovery
    2.2 Regeneration and incineration with energy recovery

Calculation method:

The impacts related to the treatment of refrigerants recovered after refill will be calculated as follows:

- For a partial refill or a replacement with the recovered refrigerant and top-up:
  ➔ No refrigerant to be treated
- In case of a total refill with new refrigerant
  ➔ The quantity of refrigerant to be treated during the use stage is equal to:

$$N \times \varepsilon_r \times S_r \times C_t$$

Thus,

- The collection distance to be taken into account will be 1000 km in a truck by default for the total refrigerant quantity (recovered or not).
- The quantity of refrigerant incinerated (without energy recovery) is calculated as follows:
    1. $100\% \times N \times \varepsilon_r \times S_r \times C_t$ for CFC refrigerants
    2. $10\% \times N \times \varepsilon_r \times S_r \times C_t$ for other types of refrigerants
- The quantity of refrigerant recovered (regeneration or incineration with energy recovery) is calculated as follows:
    1. 0% for CFCs,

2. $90\% * N * \varepsilon_r * S_r * C_t$ for other types of refrigerants

The table below sums up formulas to consider according to the refrigerant type

Treatment	CFC refrigerants	Other types of refrigerants
Incineration (without recovery)	$100\% * N * S_r * C_t * \varepsilon_r$	$10\% * N * S_r * C_t * \varepsilon_r$
Valorisation (regeneration ou incineration with energy recovery	0%	$90\% * N * S_r * C_t * \varepsilon_r$

Table. Quantity of refrigerants to consider by treatment according to the type of refrigerant, in the case of a total refill with a new refrigerant

Concerning refrigerant regeneration or incineration with energy recovery, only transportation to the treatment site is counted, in accordance with the stock method, which is a distance of 1000 km by lorry.

If the scenario used to analyse the reference product life cycle is different from the one specified above for the product category, it is necessary to:

- Justify and document the usage scenario used in the LCA report,
- Indicate the usage scenario used in the PEP.

Ecosystem data can be used in order to model refrigerant end of life.

3.5.4.3. Maintenance (module B2)

Any maintenance scenario different from those presented below must be justified and documented in the LCA report, and must be mentioned in the PEP.

3.5.4.3.1. Mandatory inspection

Maintenance operations are performed by a professional during a mandatory inspection. The inspection frequency must be specified at least in the LCA report. By default, the transportation shall be equal to a 100-km return trip in a van for one person (assumed weight of 80 kg) alone in his vehicle, by precising the « car passenger » ICV module.

In France, an inspection is mandatory every two years for equipment which have a capacity from 4 to 70 kW. For equipment with a capacity higher than 70 kW, maintenance can be done at the same time as the refrigerants mandatory inspection which has to occur every year.

In particular, manufacturers may apply the scenarios of European regulation No. 517/2014 ("F'Gas") to specify the frequency of maintenance operations for equipment containing fluorinated coolants (HFC type), or any other appropriate regulations.

3.5.4.3.2. Inclusion of maintenance parts

If parts are to be replaced during the service life of the product, in compliance with the manufacturer's specifications, the impact of their production, distribution and installation will have to be taken into account. The replacement of parts due to malfunction will not be taken into account.

By default, one replacement of the tank's protective anodes shall be allowed for during the product's lifetime, as well as one service call every two years. If the device is equipped with one or more active anodes or a permanent anti-corrosion system, no replacement needs to be allowed for during the reference lifetime.

The treatment of replaced components as waste must be modelled according to the assumptions of the end-of-life stage (see Section 3.5.5. "End-of-life stage").

3.5.4.3.3. Inclusion of oil changes-out

When oil changes are necessary, the oil change frequency specified by the manufacturer of the subassembly concerned is taken into consideration, combined with the impacts related to the production of the new oil and the impacts related to the disposal of the used oil. For this aspect, all the oil is considered to be treated (50% regeneration, 50% incineration with energy recovery).
Oil changes are considered to be carried out during a mandatory inspection, so that no additional transportation needs to be counted.

3.5.4.3.4. Inclusion of refrigerant changes-out

To take refrigerant changes into account, refer to Section 3.5.4.1. "Consideration of refrigerants during use stage".

3.5.4.4. Energy consumption (module B6)

3.5.4.4.1. Usage profile considered for heating or cooling

For each product that consumes energy during use stage, a typical use scenario for calculating the environmental impacts related to such energy consumption has been defined.
This use scenario is defined for each of the product categories in European standard EN 14825, which is mentioned in Regulation No. 813/2013, n° 2016/2281 et n° 206/2012.
This standard gives an annual energy consumption according to a given operating time representative of the average use observed in Europe, and takes the following into consideration:

- Seasonal performance of the products
- Operating time

By default, the following hypotheses are adopted:

- Average climate (equivalent to Strasbourg)

If the equipment is declared for many temperature applications in heating mode, in the ecoconception regulation framework, the data relating to the hottest temperature must be used.

3.5.4.4.2. Use profile in domestic hot water production

The draw-off profile used is the one defined according to regulation No 813/2013 or the EN 16147 standard.

The draw-off profile chosen must be indicated in the PEP.

3.5.4.4.3. Calculation method

The energy consumption calculation relates to the reference flow perimeter only.
For example, in the case of a heat exchanger, if the product does not include the circuit feed pumps, the consumption related to the use of the reference product does not include the consumption by the pumps.

If the use scenario for the life cycle analysis of the reference product is not given in the EN 14825 standard (for heating or cooling), in the EN 16147 standard (for domestic hot water), or is fundamentally different from it, you must:

- Justify and document the usage scenario used in the LCA report,
- Indicate the usage scenario used in the PEP.

For all the families products concerned, except hybrid heat pumps and VRF :

Let C_{tot} be the total energy consumption of the reference product over its reference lifetime. The energy consumption in the use stage is calculated as follows:

- For non-reversible heat (or cold) production devices:
  - Use in heating mode only:

$$Ctot\ (in\ kWh) = \frac{P_h}{\mathrm{SCOP} * (1 + \frac{\mathrm{Fregul}}{100})} * theating * RLT$$

  - Use in cooling mode only:

$$Ctot\ (in\ kWh) = \frac{P_c}{\mathrm{SEER}} * tcooling * RLT$$

  - Use in combined mode (heating and domestic hot water production):

$$C_{tot}\ (in\ kWh) = \frac{P_h}{\mathrm{SCOP} * (1 + \frac{\mathrm{Fregul}}{100})} * t_{heating} * RLT + AEC * RLT$$

  - Use in domestic hot water production solely (for heat pumps not supplied with hot water tank)

$$C_{tot}\ (en\ kWh) = AEC * RLT = \frac{(Q_{ref} + S * 24)}{(F * COP_{rated})} * 220 * DVR$$

- For reversible heat and cold production devices:
  - Use in heating and cooling mode:

$$Ctot\ (in\ kWh) = \left(\frac{P_h}{\mathrm{SCOP} * (1 + \frac{\mathrm{Fregul}}{100})} * theating + \frac{P_c}{\mathrm{SEER}} * tcooling \right) * RLT$$

  - Use in triple service (heating, cooling and hot water production):

$$C_{tot}\ (in\ kWh) = \left(\frac{P_h}{\mathrm{SCOP} * (1 + \frac{\mathrm{Fregul}}{100})} * t_{heating} + \frac{P_c}{\mathrm{SEER}} * t_{cooling} \right) * RLT + AEC * RLT$$

With:

-Fregul = 4 (class VI) by default for heat pump x/water and 0 for heat pumps or air conditioners x/air

-P_h or P_c = capacity of the equipment defined according to the European eco design regulations or European standards in force:

Type of generator	P_h	P_c
Heat pump air/water or water/water used in heating-only mode with P ≤ 400 kW (Regulation n°813/2013)	Pratedh	NA*
Heat pump or air conditioner air/air reversible or not with P ≤ 12 kW (Regulation n°206/2012)	Pdesignh	Pdesignc
Heat pump water/air (Regulation 2016/2281)	Prated,h	Prated,c
Heat pump or air conditioner air/air or rooftop units, reversible or not with 12 kW < P ≤ 1 MW (Regulation n°2016/2281)	Prated,h	Prated,c
Chiller (comfort chiller) air/water or water/water used in cooling-only mode with P ≤ 2 MW or reversible P between 400 kW and 2 MW (Regulation n°2016/2281)	NA*	Prated,c
Other cases	Thermal capacity	Thermal capacity

*NA = not applicable

-SCOP = seasonal coefficient of performance for heating according to EN 14825

-SEER = seasonal energy efficiency ratio for cooling according to EN 14825

-$t_{heating}$ = number of equivalent active mode hours of the device on active heating mode

-$t_{cooling}$ = number of equivalent active mode hours of the device on active cooling mode

-AEC = annual energy consumption of electricity for hot water for the declared according to the regulation n°811/2013 expressed in kWh

-RLT = reference life time of the device

- COP_{rated} =
  - Heat pump coefficient of performance in rating conditions of the EN14511 standard for the application temperature of 45°C
  - For heat pumps on solar collector: NF EN 14511, under the temperature conditions 10°C/45°C
  - For heat pumps on grey water: NF EN 14511, under the temperature conditions 19°C/45°C
  - For CO2 heating heat pumps : COP (7°C/Temp water inlet =15° with Temp water outlet > 55°C
- F = 0,919
- Qref : domestic hot water need according to load profile, kWh
- S : thermal loss of the tank, C class of the default ERP, kW

For Qref et S, we consider the following default values, according to the capacity heat pump

Heat pump capacity (heating, according to 813/2013 regulation)	Tank volume (L)	Thermal loss (kW)	Load profile	Qref (kWh)
4-30 KW	500-3000L	0,222	3XL	46,76
30-50 KW	750-5000L	0,268	4XL	93,52
50-100 KW	1000-10000L	0,348	4XL	93,52

When the manufacturers do not provide SCOP or SEER, they can be obtained from the provisions defined in the ecoconception regulations in force. For example, for heat pump under regulation n°813/2013, the formula is the following:

SCOP ou SEER = $\frac{(seasonal\ ratio+3)\times Pef}{100}$

This formula includes the influence of a conversion factor of the electricity in primary energy named “PEF” which the value is defined in the eco design regulation.

To calculate the energy consumption, the active mode duration by default are the followings:

Type of generators	t heating (h)	t cooling (h)
air/air P < 12 kW	1400	350
air/air P > or = 12 kW including rooftops and VRF (indoor/outdoor units)	1400	600
air/water or water/water	2066	600
water/air	1400	600

Any other use scenario used for the calculation must be justified in the LCA report and mentioned in the PEP.

Hybrid heat pumps specific cases:

For hybrid heat pumps which gather under the same reference a heat pump and a boiler, the energy consumption calculation has to distinguish electricity consumption from fuel energy consumption for heating, domestic hot water production, and if applicable cooling.

Let C_{tot} the total energy consumption of the reference product on its reference lifetime.

The energy consumption calculation during use phase for hybrid heat pumps is the following one :

1. Heating consumption

Two testing methods exist for heating: the separated method and the combined method, both described in the EN14825 standard.

The separated method tests separately heat pump parts and boilers parts and allows to separately get the annual heat pump consumption for heating and the annual boiler consumption for heating.

The combined method explains how to calculate electricity heating annual consumptions on one hand, and to calculate fuel heating annual consumptions on the other hand, from data on different levels of temperatures, according to the SCOP calculation method described in the standard.

$$\boxed{C_{tot-elec-heating}\ (kWh) = \ Q_{elec-heating} * RSL}$$

$$\boxed{C_{tot-fuel-heating}\ (kWh) = \ Q_{fuel-chauffage} * RSL}$$

With

- Qelec-heating : annual electricity consumption for boilers and heat pumps heating in kWh ; Qelec-heating = QHE+Qelec-heating (boilers)
- Qfuel-heating : annual fuel energy consumption for boilers heating in kWh

2. Energy consumption for the production of domestic hot water

In the case of a hybrid heat pump producing domestic hot water and heating, energy consumption relating producing domestic hot water must be added to heating consumption for each energy, if applicable*. These consumptions are part of product required information, according to the European regulation 813/2013.

$$\boxed{C_{tot-elec-ECS}\ (kWh) = \ 220 * Q_{elec-ECS\ (heatpump\ and\ boiler)} * RSL}$$

$$\boxed{C_{tot-fuel-ECS}\ (kWh) = \ 220 * Q_{fuel-ECS\ (heatpump\ and\ boiler)} * RSL}$$

With:

- $Q_{elec-ECS}$: daily electricity consumption for domestic hot water for the heat pump and the boiler
- $Q_{fuel-ECS}$: daily fuel energy consumption for domestic hot water for the boiler
- ECS = domestic hot water

* Domestic hot water can only be produced by a boiler. If so, domestic hot water consumption is only due to the boiler.

Any other use scenario taken into account for the calculation must be justified in the LCA report and mentioned in the PEP.

VRF specific case :

1. Consumption energy calculation related to indoor unit:

$$C_{indoor\ unit} = P_{input} * (t_{heating} + t_{cooling}) * RLT$$

With Pinput = the power input of the indoor unit considered
The use of $t_{cooling}$ and $t_{heating}$ has to be adapt according to the operating mode of the indoor unit considered, whether it's reversible or not.

2. Consumption energy calculation related to outdoor unit:

The energy consumption is calculated according to the method defined above for the calculation of Ctot, by deducing the consumption related to indoors units considered in the test report according to the EN 14511 standard.

$$C_{outdoor\ unit} = C_{tot} - (C_{indoor\ unit} * N_{unit})$$

With

- N_{unit} = the number of indoor units considered in the test report according to EN14511 standards.

The number of indoor units considered in the test report must be documented and justified in the LCA report. If there is no justification, the energy consumption calculation of the outdoor unit equals to C_{tot}.

3.5.4.5. Consideration of water consumption and liquid waste (module B7)

If the equipment needs water in order to function, the quantity of water consumed must be entered in the PEP, taking into account the type of water and the type of circulation.

- Only consumption of pre-treated water (mains water, demineralised water, etc.) should be considered, along with any additional treatments (e.g. brine, etc.)
  - In the case of circulation of pre-treated water in an open loop, the quantity of water consumed must be calculated (e.g. atomisers on the chillers). Pre-discharge treatments must also be taken into account. The chosen calculation method must be documented in the LCA report.
  - In the case of circulation of pre-treated water in a closed loop, the quantity of water consumed throughout the equipment life cycle is equivalent to the volume of the equipment's water circuit plus any top-ups due to evaporation over the reference lifetime.
- Because the consumption of water taken up and discharged directly in the same medium does not change the average temperature of the source, the effects are considered to be negligible, so not modelled.

3.5.5. End-of-life stage

Equipment that has reached the end of its life could need two types of treatment, described below:

- Special treatment for the bare product, drained of all oil or other refrigerants
- Special treatment for the liquids (refrigerant, oil, and water).

3.5.5.1. Treatment of waste generated during the end-of-life stage

Within the European Union, waste from thermodynamic generators is classed as WEEE (Waste from Electrical and Electronic Equipment).

After presenting the local requirements for managing end-of-life thermodynamic generators, the LCA report will explain the organisation of known disposal and/or recovery systems, the associated environmental impacts and how the manufacturer shall meet these requirements, if applicable. These items will determine the applicable end-of-life treatment (case 1, 2 or 3 explained below).

ICV Ecosystem modules can be used solely in France and Europe.

For the devices which are not concerned by the WEEE Directive and/or if there is no justification on the end of life treatment for these equipment, the default scenario from the current PCR (PEP-PCR-ed4-EN-2021 09 06) apply.

By sector-based agreement, the collection transport and transfer of the end of life product from the use site until its last treatment site is accounting as a transport hypothesis of 100 km in lorry for France scope.

3.5.5.2. Treatment of refrigerants in the end-of-life stage

3.5.5.2.1. Treatment of refrigerants

There is a two-stage process for the end of life stage for refrigerants:

1. Recovery of refrigerant on the working site, and treatment of the refrigerant.
    - 1.1 Collection of refrigerant (transport),
    - 1.2 Treatment of refrigerant
        - a) Incineration without energy recovery
        - b) Regeneration and incineration with energy recovery
2. Treatment of equipment at end of life
    - 2.1 Direct leakages of non-recovered refrigerant.

When recovering the equipment at the working site, the quantity of refrigerant collected is calculated as follows: C_t x S_r. The default transport distance considered for collection of the refrigerants is 1000 km.

The impacts related to the regeneration of refrigerant or its incineration with energy recovery will not be taken into account in accordance with the stock method.

The quantity of refrigerant incinerated (without energy recovery) is calculated as follows:

- 100% x $\varepsilon_r \times C_t$ for CFCs
- 10% x $\varepsilon_r \times C_t$ for other types of refrigerants

The quantity of refrigerant recovered (regeneration or incineration with energy recovery) is calculated as follows:

- 0% for CFCs,
- $90\% * \varepsilon_r * C_t$ for other types of refrigerants

During treatment of the equipment, a quantity equal to (1 - ε_r) x C_t will be considered as being discharged directly into the air when the equipment is crushed.

If the scenario used to analyse the reference product life cycle is different from that specified above for the category of product, it is necessary to:

- Justify and document the end of life scenario used in the LCA report,
- Indicate the end of life scenario used in the PEP.

3.5.5.2.2. Treatment of oils

All the oil is considered to be treated (50% regeneration, 50% incineration with energy recovery), so only the impacts related to transportation to the treatment site are taken into account.
Oil changes are considered to be carried out during a mandatory inspection, so that no additional transportation needs to be counted.

By sector-based agreement, the transportation shall be equal to a 100-km return trip in a lorry.

3.5.5.2.3. Treatment of water

For the treatment of water, we consider a treatment process for industrial waste water.

3.5.6. Benefits and loads beyond the system boundaries (module D)

For this step, the rules defined in in the current PCR (PEP-PCR-ed4-EN-2021 09 06) apply.

3.6. Rules for extrapolation to a homogeneous environmental family

These rules are additional to section 2.6. "Rule(s) for extrapolation to a homogeneous environmental family" of the PCR (PEP-PCR-ed4-EN-2021 09 06).

The following paragraphs detail the conditions of belonging to a homogeneous environmental family and the extrapolation rules applicable to each stage of the life cycle.

To use these extrapolation rules, the manufacturer must justify in the LCA report that the range of products covered by the PEP fulfil all the conditions presented in the paragraph 3.6.1. The use of any other extrapolation rule and/or definition of environmental homogeneous family shall be justified in the LCA report.

3.6.1. Definition of a homogeneous environmental family

It is accepted that the PEP covers products different from the reference product. These other products may be named (commercial references) in the PEP and in the LCA file, if they belong to the same homogeneous environmental family as the reference product.
A homogeneous environmental family means a group of products satisfying the following characteristics:

- Same function
- Same product standard
- Same manufacturing technology: same type of materials and same manufacturing processes

It's mandatory to mention on the PEP, the framework of validity of the extrapolation rules application based on technical criteria, in order to check that the products belong to the same homogeneous environmental family as the typical product.

3.6.2. Application of extrapolation rules

If the conditions to belong to a homogeneous environmental family as defined in the paragraph 3.6.1 are satisfied, the extrapolation rules to be applied for each stage of the life cycle are those given in the paragraphs from 3.6.3 to 3.6.8. These rules are applicable at the product level (or declared unit). The extrapolation coefficients calculation at the functional unit level shall take into account the instructions of the paragraph 3.6.3 to 3.6.8 which use the following formula:

$$Extrapolation\ coefficient\ at\ the\ product\ level \times \left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$$

The capacity to take into account is defined in the paragraph 3.9.

NOTE - The application of the extrapolation rules generates strong variations on the ODP indicator, the use of modeling from primary data is recommended if the manufacturer wishes to obtain more representative values for this indicator.

For multisplit heat pumps which the number of indoor units can change, extrapolation coefficients are calculated in separated ways for the outdoor unit and the indoor unit, then the calculation for extrapolation rules has to be done as following:

$$\begin{aligned} &Indicators\ of\ the\ product\ considered \\ &\quad = (outdoor\ unit\ indicators * outdoor\ unit\ extrapolation\ rules) \\ &\quad + (indoor\ unit\ indicators * indoor\ unit\ extrapolation\ rules) \\ &\quad * number\ of\ indoor\ units \end{aligned}$$

In this case, the PEP has to present indicators results for the reference product (indoor unit + outdoor unit) as well as a separated table for the indoor unit and a separated table for the outdoor unit.

The rule above doesn't apply to VRF for which there must be two separated PEP for the outdoor unit and the outdoor unit. Moreover, they have their specific extrapolation rules.

3.6.3. Extrapolation rule applied to manufacturing stage

The environmental impacts generated during the manufacturing stage are directly correlated to the total mass of the thermodynamic generator including its packaging.

For the manufacturing stage, the extrapolation rule to be applied to the reference product to evaluate the impact of any other thermodynamic generator within the same product family is the following one:

Coefficient at the declared product level (or declared unit level)	$\left(\frac{Mass\ of\ the\ product\ considered + Mass\ of\ packaging\ of\ the\ product\ considered\ (kg)}{Mass\ of\ the\ reference\ product + Mass\ of\ packaging\ of\ the\ reference\ product\ (kg)}\right)$
Coefficient at the functional unit level	$\left(\frac{Mass\ of\ the\ product\ considered + Mass\ of\ packaging\ of\ the\ product\ considered\ (kg)}{Mass\ of\ the\ reference\ product + Mass\ of\ packaging\ of\ the\ reference\ product\ (kg)}\right) \times \left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$

3.6.4. Extrapolation rule applied to distribution stage

The environmental impacts generated during the distribution stage are directly correlated to the total mass of the thermodynamic generator including its packaging.

For the distribution stage, the extrapolation rule to be applied to the reference product to evaluate the impact of any other thermodynamic generator within the same product family is the following one:

Coefficient at the declared product level (or declared unit level)	$\left(\frac{Mass\ of\ the\ product\ considered + Mass\ of\ packaging\ of\ the\ product\ considered\ (kg)}{Mass\ of\ the\ reference\ product + Mass\ of\ packaging\ of\ the\ reference\ product\ (kg)}\right)$
Coefficient at the functional unit level	$\left(\frac{Mass\ of\ the\ product\ considered + Mass\ of\ packaging\ of\ the\ product\ considered\ (kg)}{Mass\ of\ the\ reference\ product + Mass\ of\ packaging\ of\ the\ reference\ product\ (kg)}\right) \times \left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$

3.6.5. Extrapolation rule applied to installation stage

The environmental impacts generated during the installation stage are directly correlated to the total mass of the packaging of the thermodynamic generator.

For the installation stage, the extrapolation rule to be applied to the reference product to evaluate the impact of any other thermodynamic generator within the same product family is the following one:

Coefficient at the declared product level (or declared unit level)	$\left(\frac{Mass\ of\ packaging\ of\ the\ product\ considered\ (kg)}{Mass\ of\ packaging\ of\ the\ reference\ product\ (kg)}\right)$
Coefficient at the functional unit level	$\left(\frac{Mass\ of\ packaging\ of\ the\ product\ considered\ (kg)}{Mass\ of\ packaging\ of\ the\ reference\ product\ (kg)}\right) \times \left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$

3.6.6. Extrapolation rule applied to use stage (excluding maintenance)

For the use stage, the extrapolation rules have to be applied either:

- under each module (from B1 to B7). The use stage is equal to the sum of extrapolated indicators of sub-modules B.
- or to the whole phase, according to the extrapolation rule defined in section 3.6.6.6. for module B6.

3.6.6.1. Module B1

The environmental impacts generated during the module B1 are related to momentary leakages refrigerants and are therefore based on the leakage rate considered.

- If the leakage rate at this step is the default leakage rate (paragraph 2.5.4.1.1.)

Coefficient at the declared product level (or declared unit level	$\left(\frac{Total\ number\ of\ units\ for\ the\ product\ considered * 3\ +\ Total\ number\ of\ fittings\ for\ the\ product\ considered * 5}{Total\ number\ of\ units\ for\ the\ reference\ product * 3\ +\ Number\ total\ of\ fittings\ for\ the\ reference\ product * 5}\right)$
Coefficient at the functional unit level	$\frac{Total\ number\ of\ units\ for\ the\ product\ considered * 3\ +\ Total\ number\ of\ fittings\ for\ the\ product\ considered * 5}{Total\ number\ of\ units\ for\ the\ reference\ product * 3\ +\ Number\ total\ of\ fittings\ for\ the\ considered\ product * 5} \times \left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$

Note : The total number of units equals to the total number of units for the product (indoor and/or outdoor units)

- If the leakage rate is a specific leakage rate given in % per year (paragraph 2.5.4.1.1.)

Then the leakage rate depends on the initial refrigerant fill. In this case, environmental impacts generated are correlated to the initial refrigerant fill.

The extrapolation rule to be applied to the reference product to evaluate the impact of any other thermodynamic generator within the same product family is the following one :

Coefficient at the declared product level (or declared unit level	$\frac{Initial\ refrigerant\ fill\ of\ the\ product\ considered\ (kg)}{Initial\ refrigerant\ fill\ of\ the\ reference\ product\ (kg)}$
Coefficient at the functional unit level	$\left(\frac{Initial\ refrigerant\ fill\ of\ the\ product\ considered\ (kg)}{Initial\ refrigerant\ fill\ of\ the\ reference\ product\ (kg}\right) \times \left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$

3.6.6.2. Module B2

Environmental impacts generated during maintenance stage are due to the annual transport of the operator and renewal of maintenance parts. They are considered as exactly the same within the homogeneous family.

- In the case of total refrigerant refill, if the impact is significant (see chapter 4.4.2. of the appendix A of PCR4), the declarant has to define the extrapolation rule.
- Otherwise, environmental impacts generated are considered as identical within the homogeneous environmental family.

3.6.6.3. Module B3

Not applicable

3.6.6.4. Module B4

Not applicable

3.6.6.5. Module B5

Not applicable

3.6.6.6. Module B6

Environmental impacts generated during module B6 are correlated to the thermodynamic generator total energy consumption.

The extrapolation rule to be applied to the reference product to evaluate the impact of any other thermodynamic generator within the same product family is the following one :

Coefficient at the declared	$\left(\frac{Total\ energy\ consumption\ of\ the\ product\ considered\ (kWh)}{Total\ energy\ consumption\ of\ the\ reference\ product\ (kWh)}\right)$

product level (or declared unit level)	
Coefficient at the functional unit level	$\left(\frac{Total\ energy\ consumption\ of\ the\ product\ considered\ (kWh)}{Total\ energy\ consumption\ of\ the\ reference\ product\ (kWh)}\right) \times \left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$

For the heat pumps which can be used at different temperature ranges, extrapolation rules can be applied and the temperature regime has to be specified in the title.

3.6.6.7. Module B7

Water consumption is constant for each product considered, which belongs to the homogenous environmental family. The extrapolation rule to be applied to the reference product to evaluate the impact of any other thermodynamic generator within the same product family is the following one :

Coefficient at the declared product level (or declared unit level)	1
Coefficient at the functional unit level	1x $\left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$

3.6.7. Rules of extrapolation applied to end of life stage

The environmental impacts generated during the end of life stage are directly correlated to the total mass of the thermodynamic generator.

For the end of life stage, the extrapolation rule to be applied to the reference product to evaluate the impact of any other thermodynamic generator within the same product family is the following one:

Coefficient at the declared product level (or declared unit level)	$\left(\frac{Mass\ of\ packaging\ of\ the\ product\ considered\ (kg)}{Mass\ of\ the\ packaging\ of\ the\ reference\ product\ (kg)}\right)$
Coefficient at the functional unit level	$\left(\frac{Mass\ of\ the\ product\ considered\ (kg)}{Mass\ of\ the\ reference\ product\ (kg)}\right) \times \left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$

3.6.8. Rules of extrapolation for benefits and loads beyond the system boundaries stage

Following a documented sensitivity study, it has been proved that environmental impacts of these systems from phase A1 to phase C4 are proportional to their mass. An extrapolation process applying to all the Life Cycle Assessment phases has been made and appears in the table below.
Factors that change module D are :

- Recycled content of raw materials quantities used for manufacturing phase
- Loss quantities and waste generated during the Life Cycle Assessment, and their treatment.

These factors are directly related to the mass of the product and should not vary within a homogeneous environmental family (paragraph 2.6. of the current PCR (PEP-PCR-ed4-EN-2021 09 06): “similar manufacturing technology: same type of materials and manufacturing processes”).
Then, extrapolation rules based on the mass of the product can be applied to module D.
Environmental impacts generated during benefits and loads beyond the system boundaries stage are mainly correlated to the total mass of the product and its packaging.

For module D stage, the extrapolation rule to apply to the reference product in order to evaluate the impact of every thermodynamic generator of the same range is the following one :

Coefficient at the declared product level (or declared unit level)	$\left(\frac{Mass\ of\ the\ product\ considered + Mass\ of\ packaging\ of\ the\ considered\ product\ (kg)}{Mass\ of\ the\ reference\ product + Mass\ of\ the\ packaging\ of\ the\ reference\ product\ (kg)}\right)$
Coefficient at the functional unit level	$\left(\frac{Mass\ of\ the\ product\ considered + Mass\ of\ packaging\ of\ the\ product\ considered\ (kg)}{Mass\ of\ the\ reference\ product + Mass\ of\ packaging\ of\ the\ reference\ product\ (kg)}\right) \times \left(\frac{Power\ of\ the\ reference\ product}{Power\ of\ the\ product\ considered}\right)$

3.7. Rules applying to joint environmental declarations

These rules are complementary to PCR section 2.7. "Rules applying to joint environmental declarations" (PEP-PCR-ed4-EN-2021 09 06).

For a joint environmental declaration, the analysis must cover a "typical product" compliant with the rules defined in Section 3.1.3 "Reference product and reference flow description" of these specific rules. Moreover, the application validity framework of rules of extrapolation based on technical criteria shall be mentioned in the PEP, so that it’s possible to check that products belong to the same environmental family as the typical product.
To be part of a joint PEP, in addition of meeting the validity framework, the product has to check the following condition: using a refrigerant with a global warming potential (GWP) smaller than the highest covered by the joint PEP.

3.8. Requirements concerning environmental data

3.8.1. Requirements concerning the collection of primary and secondary data

These rules are additional to the sections 2.9.1. "Requirements for the collection of primary data" and 2.9.2. "Requirements for secondary data" of the PCR (PEP-PCR-ed4-EN-2021 09 06).

As far as possible, the primary data (i.e. all the data associated with the manufacturing stage of the reference product and specific to an organisation) is to be preferred and shall be justified in the LCA report, specifying:

1) primary data in case of a single supplier,
2) in case of procurement from several suppliers, the primary data to be taken into account is the data provided by major suppliers representing at least 50% of the procurement volume (with regard to the total quantity bought). For example, for ten suppliers each providing 10% of the procurement volume, at least five suppliers shall be considered in order to obtain an overall view of the primary information provided. Any other distribution rule should be justified in the LCA report and in the PEP.

If primary data are shared with other products than those referred to these specific rules, the calculation of impacts will be done in proportion to the mass of the devices manufactured.

This information is not always available to manufacturers of thermodynamic generators with electric compression: for lack of primary data, secondary data, i.e. data obtained from the life cycle assessment software database shall be used. PCR (PEP-PCR-ed4-EN-2021 09 06) explains how to select the LCI modules. If the transportation information is not available, the data defined in section 2.5.3. "Transport scenarios" of the current PCR (PEP-PCR-ed4-EN-2021 09 06) will be used.

The ICV module used to model the raw material or the component can include a default loss rate.

- If the default loss rate included in the ICV module can be changed: Default values defined in the paragraph 3.5.1.4. have to be applied.
- If the default loss rate included in the ICV can not be changed:
    - The loss rate is below the default values defined in the paragraph 3.5.1.4. : this loss rate has to be mentioned in the LCA report and the modelling has to be adapted as much as possible in order to take into account the difference between generated waste (hazardous or non-hazardous)
    - The loss rate is higher to the default values defined in the paragraph 3.5.1.4. : the loss rate has to be mentioned in the LCA

3.8.2. Evaluation of data quality

The rules given in the paragraph 2.9.3. « Evaluation of data quality and characteristics » of the current PCR (PEP-PCR-ed4-EN-2021 09 06) apply.

3.9. Calculation of environmental impact

To ensure consistency of the results of environmental impacts between the functional unit and the reference product, the PEP shall show the environmental impacts of the manufacturing, distribution, installation, use (including maintenance) and end-of-life stages as follows:

Environmental impacts from the PEP (for 1 kW) =
Environmental impacts of the reference product / Power of the reference product

- For on-reversible heat (or cold) production devices:
  - Use in heating-only mode and/or combined mode with domestic hot water production:
    Power of reference product = P_h of reference product
  - Use in cooling mode only:
    Power of reference product = P_c of reference product
  - Use in domestic hot water production only :
    Power of reference product = P_c of reference product

- For reversible heat and cold and/or combined equipment with domestic hot water production:
  Power of reference product = P_{rev}

With:

- P_h or P_c = power of the equipment defined according to the European eco design regulation or European standards in force :

Type	P_h	P_c
Heat pump air/water or water/water used in heating-only mode with P ≤ 400 kW (Regulation n°813/2013)	Pratedh	NA*
Heat pump or air conditioner air/air reversible or not with P ≤ 12 kW (Regulation n°206/2012)	Pdesignh	Pdesignc
Heat pump water/air (Regulation n°2016/2281)	Pratedh	Pratedc
Heat pump or air conditioner air/air or rooftop, reversible or not with 12 kW < P ≤ 1 MW (Regulation n°2016/2281)	Pratedh	Pratedc
Chiller (comfort chiller) air/water or water/water used in cooling-only mode with P ≤ 2 MW or reversible P between 400 kW and 2 MW (Regulation n°2016/2281)	NA*	Pratedc
Other case	Thermal power	Thermal power

*NA = not applicable

- P_{rev} = rated load of the device in cold and hot modes, with respect to the operating time in each of the modes expressed in kW and defined by the following formula:

  $P_{rev} = (t_{heating} * P_h + t_{cooling} * P_c)/(t_{heating} + t_{cooling})$

For the biogenic carbon storage, two assessment methodologies 0/0 or -1/+1 are accepted until the environmental database update. The methodology used has to be mentioned in the PEP and the LCA report.

The environmental database version has to be mentioned in the PEP and the LCA report (included the Environmental Footprint version number).

4. Drafting of the Product Environmental Profile

4.1. General information

These rules are additional to the section 4.1. "General information" of the current PCR (PEP-PCR-ed4-EN-2021 09 06).

The PEP must include:

- The product category and characteristics to be declared according to Section 2.1.
- The processes, components and energies counted in the installation stage according to Section 3.2.3
- The use profile considered in the use stage according to sections 3.5.4.1.1 and 3.5.4.1.2
- The volume of the tank for a system with production of domestic hot water
- The value of the refrigerant refill threshold during the use stage if different from the default value given in Section 3.5.5.2.2
- The quantity of water consumed in the use stage according to Section 3.5.5.3
- Any change in the default scenario as defined in Section 3.5
- For a PEP covering several products, the extrapolation coefficients as defined in paragraph 3.6.
- The mention « no additional refrigerant charge has been taken into account during installation phase »
- The installation scenario (on the ground with the concrete slab, on the roof or on the wall).

4.2. Constituent materials

The rules specified in the section 4.2. "Constituent materials" of the current PCR apply (PEP-PCR-ed4-EN-2021 09 06).

4.3. Additional environmental information

These specific rules are additional to section 4.3 "Additional environmental information" of the PCR (PEP-PCR-ed4-EN- 2021 09 06).

4.4. Environmental impacts

In the context of performing Life Cycle Analyses on a building-wide level, the environmental impacts of the equipment must be considered on the scale of the product and the impacts related to energy consumption in the use stage must be treated separately.

To facilitate the use of the PEP in conducting a building LCA, the PEP may include:

- The table of the environmental impacts of the reference product expressed on the product (or declared product) scale in addition to the table on the functional unit scale. The values must then be indicated in numerical values, expressed in the appropriate units to three significant figures (and, optionally, as a percentage) for each stage of the life cycle, and the total for each indicator of the complete life cycle analysis.

  The following details must be included in the PEP, to ensure clarity and transparency for the user:
  - For environmental impacts expressed per functional unit, the following wording must be included: "per kW corresponding to the functional unit"
  - For environmental impacts expressed per declared product, the following wording must be included: “per device corresponding to the reference product"

The table of environmental impacts represents the environmental impact of the functional unit, i.e. the production of 1 kW of heating and/or 1 kW of cold and/or of domestic hot water.

Thus, the total impact of the installed product must be calculated by the user of the PEP according to the power of the equipment by multiplying the impact concerned by the total number of kW of heating and/or cooling required by the installation.

The following details must be completed and included in the PEP, to ensure clarity and transparency for the user:
The PEP was drawn up under the assumption 1 kW of heating power being supplied. The real impact of the stages of the life cycle of a product installed in an actual situation is calculated by the user of the PEP by multiplying the impact concerned by the total heating capacity** in kW.*

* to be specified according to the functions performed by the equipment: 1 kW of cooling, 1 kW of heating or cooling, 1 kW of heating and domestic hot water production, 1 kW of heating or cooling and domestic hot water production.

** to be specified according to the functions performed by the equipment: cooling, heating and cooling.

When extrapolation rules are used, the following statement must be included:
Extrapolation coefficients are given for the environmental impact of the functional unit, i.e. the emission of 1 kW heating power. For each stage of the life cycle, the environmental impacts of the product concerned are calculated by multiplying the impacts of the declaration corresponding to the reference product by the*

extrapolation coefficient. The "Total" column should be calculated by adding the environmental impacts of each stage of the life cycle.

* to be specified according to the functions performed by the equipment: 1 kW of cooling, 1 kW of heating or cooling, 1 kW of heating and domestic hot water production, 1 kW of heating or cooling and domestic hot water production.

5. PEP Updates Rules

Every EPD registered by PEP association shall be updated and subjected to a new registration if the concerned product increase of more than 5% :

- In mass
- In new sub-components
- In environmental indicators considered as significant
- Any other element considered as significant
- In used material

6. Appendices

6.1. Glossary

AEC	Annual electricity consumption in domestic hot water production mode for the chosen draw-off profile
C_i	Quantity of refrigerant introduced during installation stage
C_n	Rated load equivalent to the quantity of refrigerant added during manufacturing stage
C_t	Total load in the equipment when operating
EEE	Electrical and Electronic Equipment
E_{fi}	Momentary leakage in installation stage
E_{fp}	Momentary leakage during production stage at assembly site
E_{fu}	Momentary leakage in use stage
ε_r	Efficiency of recovery
EN	European standard
kg	Kilogram
kWh	Kilowatt hour
LCA	Life cycle analysis
LCI	Life cycle inventory
N	Number of refills during reference lifetime
PCR	Product category rules
$P_{design\ c}$	Rated cooling capacity according to EN 14825
$P_{design\ h}$	Rated heating capacity according to EN 14825
PEP	Product environmental profile
Primary data	Actual data measured by the manufacturer or supplier
PSR	Product specific rules
RLT	Reference lifetime

SCOP	Seasonal performance coefficient
Secondary data	Generic data from a database or according to sector-based agreement
SEER	Seasonal cooling capacity
S_r	Refill threshold
$t_{cooling}$	Number of equivalent annual operating hours of the device in cold production
T_{fp}	Rate of leakage at assembly site
T_{fu}	Rate of leakage in use stage
$t_{heating}$	Number of equivalent annual operating hours of the device in heat production
Wh	Watt hour

6.2. References

Chapter	Subject	Source
2.1. Definition of the product families concerned	EN 14511	This Standard specifies the terms and definitions for the rating and performance of air conditioners, liquid chilling packages and heat pumps using either air, water or brine as heat transfer media, with electrically driven compressors when used for space heating and/or cooling.
3.1 Functional unit and reference flow description 3.5.4.3.Energetic consumption (module B6)	EN 14825	Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part load conditions and calculation of seasonal performance (September 2018 even 2022).
3.5.3.1 Momentary leakage of refrigerants during installation stage	Regulation (EU) 1516/2007	REGULATION (EC) No 1516/2007 OF THE COMMISSION dated 19 December 2007 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, standard leakage checking requirements for stationary refrigeration, air conditioning and heat pump equipment containing certain fluorinated greenhouse gases.
3.5.4 Use stage	Regulation (EU) No. 813/2013	REGULATION (EU) No. 813/2013 of the Commission dated 2 August 2013 in application of Directive 2009/125/EC of the European Parliament and the Council with regard to Ecodesign requirements for space heaters and combination heaters (Text with EEA relevance).

3.5.3. Installation stage	End of life packaging treatment default scenarios	Eurostat statistic database : https://ec.europa.eu/eurostat/databrowser/view/ENV_WASPAC__custom_3801295/default/bar?lang=fr
3.5.4.1. Consideration of the refrigerant during en étape d'utilisation (modules B1 et B2) 3.5.4.2. Maintenance (module B2)	F-Gas	European regulation n° 517/2014 relating to fluorinated greenhouse gases
3.5.4.3. Energetic consumption (module B6)	EN 16147	Heat pumps with electrically driven compressors. Testing, performance rating and requirements for marking of domestic hot water units
	Regulation n°811/2013	Delegated regulation (UE) n ° 811/2013 of the Commission of 18 february 2013 completing the directive 2010/30/UE of the Parliament and the Council with regard to the energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device Text with EEA relevance
	Regulation n°206/2012	Regulation (UE) No 206/2012 of the COMMISSION of 6 march 2012 implementing the directive 2009/125/CE of the Parliament and the Council with regard to Ecodesign requirements for air conditioners and comfort fans Text with EEA relevance
	Regulation (UE) n°2016/2281	Regulation (UE) 2016/2281 of the COMMISSION of 30 november 2016 Implementing Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the setting of Ecodesign requirements for energy-related products, with regard to Ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units (Text with EEA relevance)
4.3 Additional environmental information	EN 15804	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

	EN 15978 Standard	Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method

6.3. Application examples for extrapolation rules

Example 1: reversible triple service air/water heat pump

In this example, product C is the reference product relating to a reversible combined air/water heat pump which provides the function of heating, cooling as well as domestic hot water. The example is realised with a ventilation unit without time delay

This kind of heat pump has a 17 years reference lifetime. For the maintenance, no total refill is considered on the product lifetime.

Below, an example of typical data regarding 3 products (A, B, C) belonging to the same homogeneous environmental family.

	Product A	Product B	Product C
Pdesignh=Pratedh (kW) in BT (30-35°C)	3	6	9
SCOP in BT (30-35°C)	4,8	4,5	4,2
Pdesignh=Pratedh (kW) in MT (47-55°C)	2,8	5,1	7,9
SCOP in MT (47-55°C)	3,4	3,2	2,9
theating (h)	2066	2066	2066
Pdesignc=Pratedc (kW)	5	6	7
SEER	7,5	9	8,2
tcooling (h)	600	600	600
AEC (kWh)	1000	2000	3000
Masse of the product (packaging not included kg)	160	190	200
Mass of the packaging (kg)	9	12	14
Initial refrigerant fill (kg)	1,2	1,2	1,6
Specific leakage rate (%/year)	2	2	2

Ctot and Prev can be calculate with the typical data above :

	Product A	Product B	Product C
Prev in BT (30-35°C)	3,5	6,0	8,5
Ctot (kWh) in BT (30-35°C)	45751,3	87629,3	134968,7
Prev in MT (47-55°C)	3,3	5,3	7,7
Ctot (kWh) in MT (47-55°C)	52724,0	96775,7	155384,5

Then we get the summary of the extrapolation coefficients to supply :

		Product A Low Temperature regime (30-35°C)	Product B Low Temperature regime (30-35°C)	Product C Low Temperature regime (30-35°C)	Product A Medium Temperature regime (47-55°C)	Product B Medium Temperature regime (47-55°C)	Product C Medium Temperature regime (47-55°C)

Functional unit scale	A1-A3 : Manufacturing	1,76	1,21	0,90	1,84	1,37	1,00
	A4 : Distribution	1,76	1,21	0 90	1,84	1,37	1,00
	A5 : Installation	1,43	1,10	0,90	1,50	1,24	1,00
	B1 : Use	1,67	0,96	0,90	1,75	1,09	1,00
	B2 : Maintenance	2,23	1,28	0,90	2,34	1,45	1,00
	B3 : Repair	2,23	1,28	0,90	2,34	1,45	1,00
	B4 : Replacement	2,23	1,28	0,90	2,34	1,45	1,00
	B5 : Rehabilitation	2,23	1,28	0,90	2,34	1,45	1,00
	B6 : Energy consumption	0,66	0,72	0,78	0,79	0,90	1,00
	B7 : Water consumption	2,23	1,28	0,90	2,34	1,45	1,00
	C1-C4 : End of life	1,78	1,22	0,90	1,87	1,38	1,00
	D : Benefits and loads beyond the system boundaries	1,76	1,21	1,00	1,84	1,37	1,00
Declared product scale	A1-A3 : Manufacturing	0,79	0,94	1,00	0,79	0,94	1,00
	A4 : Distribution	0,79	0,94	1,00	0,79	0,94	1,00
	A5 : Installation	0,64	0,86	1,00	0,64	0,86	1,00
	B1 : Use	0,75	0,75	1,00	0,75	0,75	1,00
	B2 : Maintenance	1,00	1,00	1,00	1,00	1,00	1,00
	B3 : Repair	1,00	1,00	1,00	1,00	1,00	1,00
	B4 : Replacement	1,00	1,00	1,00	1,00	1,00	1,00
	B5 : Rehabilitation	1,00	1,00	1,00	1,00	1,00	1,00
	B6 : Energy consumption	0,29	0,56	0,87	0,34	0,62	1,00
	B7 : Water consumption	1,00	1,00	1,00	1,00	1,00	1,00
	C1-C4 : End of life	0,80	0,95	1,00	0,80	0,95	1,00
	D : Benefits and loads beyond the system boundaries	0,79	0,94	1,00	0,79	0,94	1,00

Example 2 : VRF

Below, an example of typical data regarding 2 products (A and B) belonging to the same homogeneous environmental family in the VRF category. This type of device has a 17 years old lifetime. The product A is the reference product with 1 outdoor unit and 4 indoor unit. Product B has the same outdoor unit but 6 indoor units.

	Product A	Product B
Power P rev (kW)	15	20
Total number of indoor units	4	6
Total number of units	5	7
Total number of fittings	10	14
Masse of the product (packaging not included kg)	145	160
Mass of the packaging (kg)	13	15
Leakage rate (g/year)	65	91
Energy consumption related to the indoor units		
P input, power input of the indoor unit (kW)	0,01	0,02
theating (h)	1400	1400
tcooling (h)	600	600
Energy consumption related to the indoor units (kW)	1360	4080
Energy consumption related to the outdoor unit		
Pratedh (kW)	14	14
SCOP	4,3	4,3
Pratedc (kW)	17	17
SEER	8	8
Fregul	0	0
Energy consumption related to the outdoor unit (kW)	26233,1	26233,1

Thus, we get the summary of the extrapolation coefficients to supply:

		Product A (reference)	Product B
Functional unit scale	**A1-A3 : Manufacturing**	1,00	0,83
	A4 : Distribution	1,00	0,83
	A5 : Installation	1,00	0,87
	B1 : Use	1,00	2,10
	B2 : Maintenance	-	-
	B3 : Repair	-	-
	B4 : Replacement	-	-
	B5 : Rehabilitation	-	-
	B6 : Energy consumption	1,00	0,82

	B7 : Water consumption	1,00	0,75
	C1-C4 : End of life	1,00	0,83
	D : Benefits and loads beyond the system boundaries	1,00	0,83
Declared product scale	**A1-A3 : Manufacturing**	1,00	1,11
	A4 : Distribution	1,00	1,11
	A5 : Installation	1,00	1,15
	B1 : Use	1,00	2,80
	B2 : Maintenance	-	-
	B3 : Repair	-	-
	B4 : Replacement	-	-
	B5 : Rehabilitation	-	-
	B6 : Energy consumption	1,00	1,10
	B7 : Water consumption	1,00	1,00
	C1-C4 : End of life	1,00	1,10
	D : Benefits and loads beyond the system boundaries	1,00	1,11

6.4. Declaration of conformity

Attestation de revue critique des
« Règles spécifiques aux générateurs thermodynamiques a compression électrique assurant le chauffage et/ou le refroidissement des locaux et/ou la production d'eau chaude sanitaire »

Chargée de revue critique	Olivia DJIRIGUIAN
Document revu	PSR - Règles spécifiques aux générateurs thermodynamiques à compression électrique assurant le chauffage et/ou le refroidissement des locaux et/ou la production d'eau chaude sanitaire
Etabli par	CSTB
Version et date	PSR-0013-ed3.0-FR-2023-05-09
Période de revue	Janvier 2023 – Mai 2023
Référentiels de revue	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
Conclusion	Le document revu ne comporte pas de non-conformité par rapports aux référentiels. Ainsi, le PSR relatifs aux générateurs thermodynamiques à compression électrique assurant le chauffage et/ou le refroidissement des locaux et/ou la production d'eau chaude sanitaire est conforme aux exigences des référentiels.
	Olivia DJIRIGUIAN Consultante ACV et éco-conception Le 06/06/2023 LABORATOIRE CENTRAL DES INDUSTRIES ELECTRIQUES F - 92266 FONTENAY AUX ROSES

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